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JUNE 1951
PRICE FIFTY CENTS

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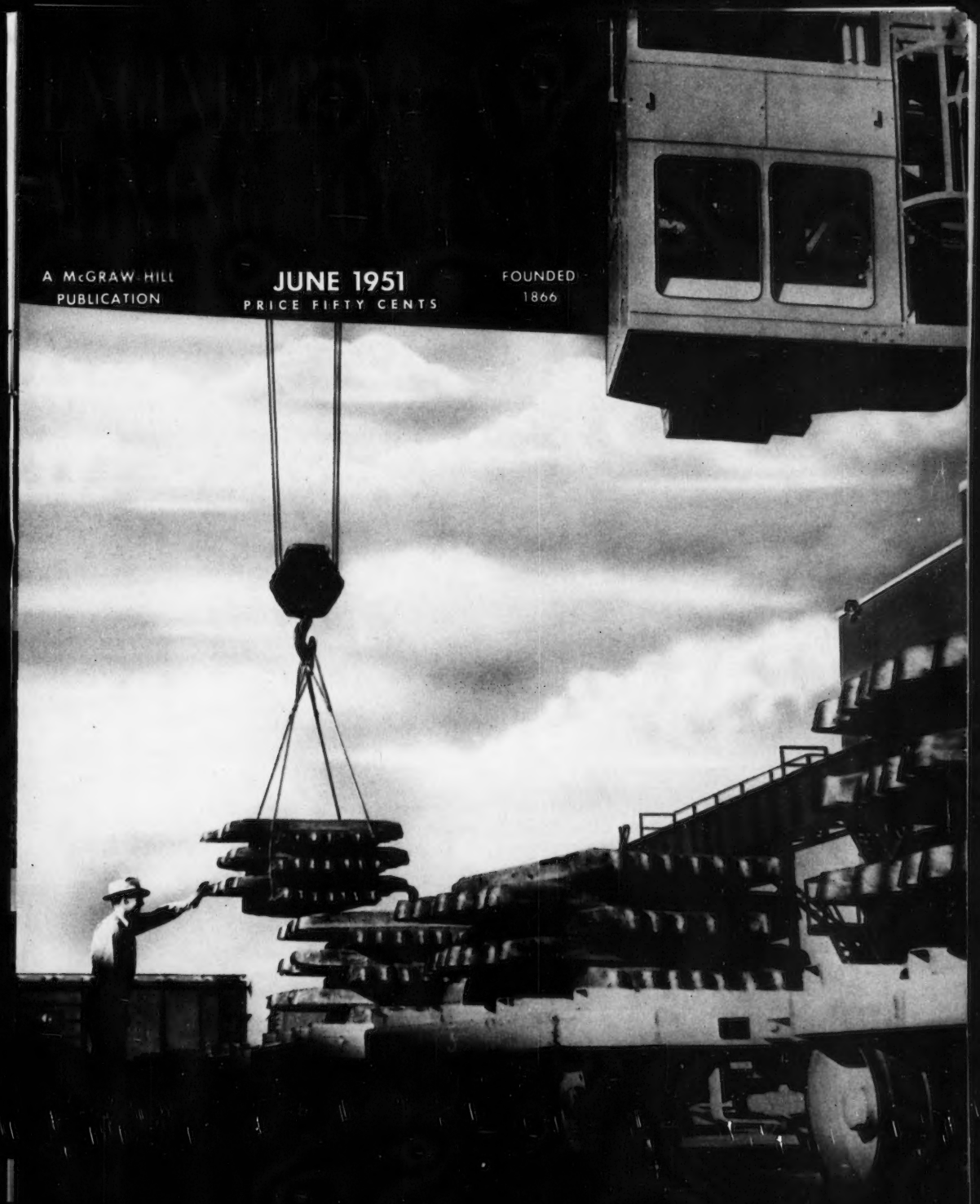


Copper Goes West—At Kennecott's New Refinery . . . P. 72

Victory Or Stalemate? Minerals Can Decide . . . P. 80

HYDROSEALS are saving money South of the Border

Air photo of a large zinc concentration plant in Mexico. Tailings dam shown in right foreground.

Hydroseal Pumps are right at home in the tough jobs that must be done cheaply and efficiently. That's why they are welcome at this large zinc concentration plant in the land of tequila and tamales.

In this operation, two C-41 Hydroseal Slurry Pumps (one acting as standby) handle the tailings at an average rate of from 760 to 1025 G.P.M., the percentage of solids by weight being from 20 to 25%. Both pumps are equipped with individual automatic speed controls to compensate for changes in volume and/or head. The T.D.H. varies from 32 to 125 ft. Discharge to the tailings dam is through 3700 ft. of 8-in. pipe.

Pumping systems like this that almost think for themselves don't just happen . . . they're the product of our ace-high engineers who are constantly designing more efficient ways of handling abrasive materials with the world-famous Hydroseal Pump. Let them help you with your pumping problems —the tougher they are, the better they like them!

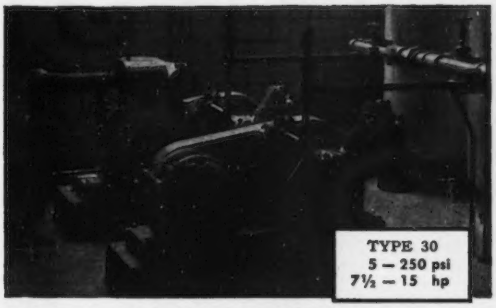
THE ALLEN-SHERMAN-HOFF PUMP CO.
229 S. 15th Street • Philadelphia 2, Pa.
Representatives in Most Principal Cities

Write for our new Catalog No. 451

HYDROSEAL SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

HYDROSEAL, PACKLESS AND MAXIMIX DESIGNS ARE COVERED BY PATENTS AND APPLICATIONS IN THE MAJOR MINING CENTERS OF THE WORLD

You can always depend on I-R compressors for real economy

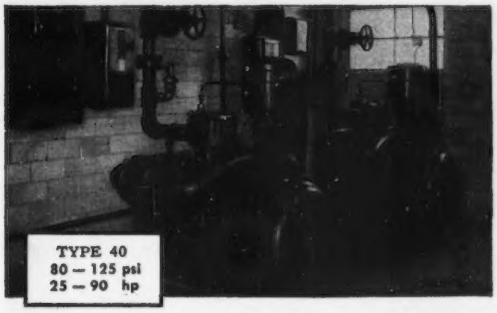


Single- and two-stage, air-cooled compressors, available as complete "packaged" air plants, with motor and compressor mounted on an air receiver — or with motor and compressor base-plate mounted for connection to separate receiver.

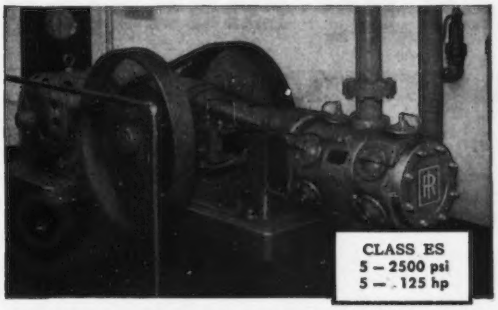
- **EFFICIENT OPERATION**
- **LOW MAINTENANCE COSTS**
- **EASY INSTALLATION**

Whatever your compressed air requirements, there's an Ingersoll-Rand compressor that's *right* for the job. As mechanical and compression efficiencies are high, the unit will deliver full rated output with consistently lower power requirements. With its rugged, dependable construction the I-R compressor will stay on the job longer, with less time out for maintenance.

You can be sure of receiving real economy from *any* Ingersoll-Rand compressor . . . a machine that is economical to install, run, and maintain. Contact your nearest I-R branch office for complete information.



High-capacity, two-stage compressors with air-cooled cylinders and intercoolers, available with three types of electric motor drive: V-belt, flexible coupling, and unit type with compressor and motor on common shaft. All units are highly efficient, compact, and light in weight.



Heavy-duty, high-pressure units with one, two, and three stages — arranged for electric-motor or steam drive. These double-acting, horizontal crosshead-type compressors, with I-R Channel Valves, and water-cooled cylinders, are built for continuous full-load service under severe operating conditions.

Heavy-duty, double-acting, two-stage, water-cooled compressors, featuring a completely new "L" design which makes them the simplest, most compact, most accessible, and most economical units ever developed. Pipeless, Thru-Frame Air Flow, packaged intercooler, and built-in electric motor save space — reduce installation, power, and maintenance costs.

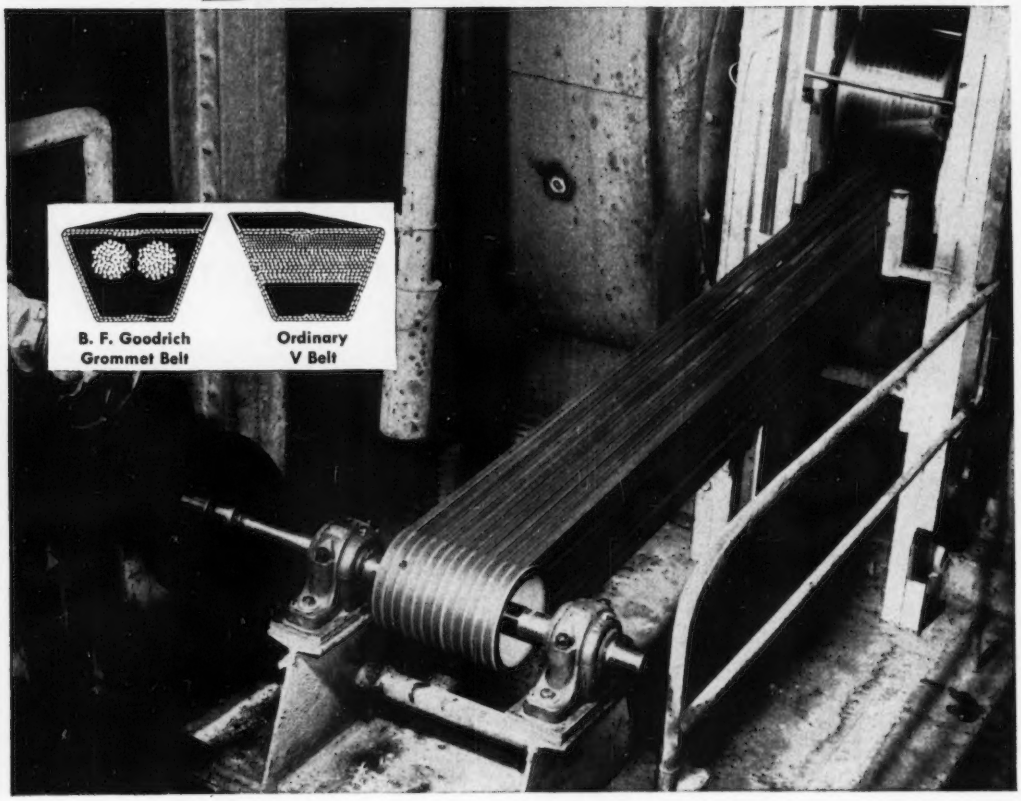
OTHER TYPES . . . AND SIZES TO 3000 HP

Ingersoll-Rand

581-1 11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS
DIESEL AND GAS ENGINES

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



Belt service tripled by changing to B. F. Goodrich grommet belts

B. F. Goodrich grommet V belts cut costs 20 to 50%

ORDINARY V belts on this drive (a big fan for drying grain) lasted 1674 hours. The company wanted to cut costs by getting longer life from belts so they called in a B. F. Goodrich man and B. F. Goodrich grommet belts were installed. Grommet V belts ran 5153 hours . . . more than three times longer than ordinary belts. Why is this a typical example of grommet belt performance — why do grommet V belts outlast other belts?

Endless — A grommet is endless, made by winding heavy cord on itself to form an endless loop. It has no overlapping cord sections. Because most of the failures in ordinary V belts occur in the region where cords overlap, the endless grommet belt eliminates such failures.

Concentrated cord strength — All of the cord material in a B. F. Goodrich grommet belt is *concentrated* in twin grommets, positioned close to the driving faces of the pulley. No layers of cords to rub against one another and generate heat; cord and adhesion failures are reduced.

Better grip, less slip — Because a grommet is endless, a grommet belt is more flexible, grips the pulleys better. Size for size, grommet belts will give ⅓ more gripping power, pull heavier loads with a higher safety factor.

Only B.F.Goodrich has the grommet! — No other multiple-V belt is a grommet belt (U. S. Patent No. 2,233,294). Now available in C, D and E sections. See your local B.F.Goodrich distributor. Ask him to show you his "X-ray" belt that illustrates grommet construction clearly. *The B.F.Goodrich Company, Industrial and General Products Division, Akron, Ohio.*

Grommet Belts BY

B.F.Goodrich

RUBBER FOR INDUSTRY

ENGINEERING AND MINING JOURNAL

VOLUME 152 — 85th YEAR OF PUBLICATION — NUMBER 6

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Published monthly by McGraw-Hill Publishing Co., Inc. James H. McGraw (1860-1948), Founder. Publication Office, 1309 Noble St., Philadelphia 23, Pa. Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 West 42nd St., New York 18, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice President; Joseph A. Gerardi, Vice President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice President and Director of Advertising; J. E. Blackburn, Jr., Vice President and Director of Circulation.

Subscriptions: Address correspondence to Engineering and Mining Journal — Subscription Service, 1309 Noble St., Philadelphia 23, Pa., or 330 West 42nd St., New York 18, N. Y. Allow ten days for change of address.

Branch Offices: San Francisco 4, 68 Post St.; Chicago 11, 520 N. Michigan Ave.; Los Angeles 17, 1111 Wilshire Blvd.; Washington, D. C.: National Press Bldg.: Pittsburgh 22, 719 Oliver Bldg.; Detroit 26, 856 Penobscot Bldg.; Cleveland 15, 1510 Hanna Bldg.; Boston 16, 1427 Statler Bldg.; Philadelphia 3, 17th and Sansom Sts.; Atlanta 3, 1011 Rhodes-Haverty Bldg.; St. Louis 3, Continental Bldg. District Managers: New York, T. E. Alcorn; New York and New England, S. Kennedy; Philadelphia, W. A. Potter; Cleveland, W. M. Spears; Pittsburgh, H. C. Chellson; Chicago, C. J. Coash; San Francisco, J. W. Otterson; Atlanta, R. C. Maultsby; Los Angeles, C. W. Dysinger; St. Louis, F. W. Roets. London address: McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, W.C. 2, England. Cable address: McGraw-Hill, London. Other McGraw-Hill foreign news offices in Paris, Berlin, Moscow, Prague, Shanghai and Mexico City.

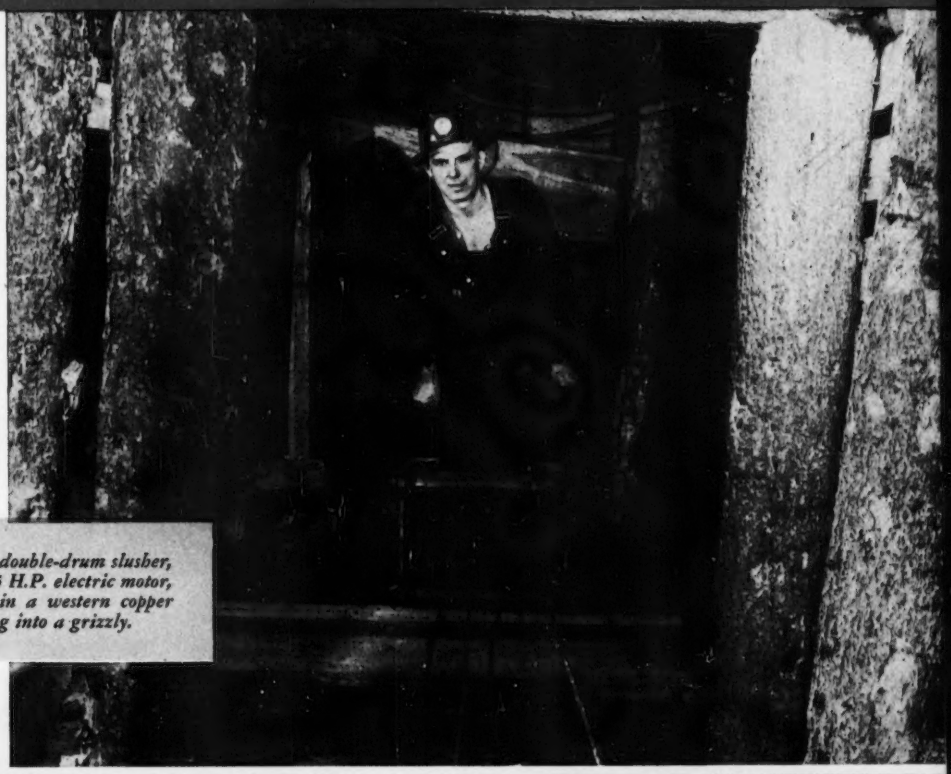
A McGRAW-HILL PUBLICATION

Member of Associated Business Publications and Audit Bureau of Circulations

Price of this issue, 50c. Subscription rates: United States and possessions, $3 a year, $4 for 2 years, $5 for 3 years. Canada $5 a year, $8 for 2 years, $10 for 3 years. Pan American countries $5 a year, $8 for 2 years, $10 for 3 years. Elsewhere $15 a year, $25 for 2 years, $30 for 3 years. Please indicate position and company connected in all subscription orders.

Entered as second class matter August 16, 1943, at the Post Office at Chicago, under the Act of March 3, 1879, pending transfer as second class matter to the Philadelphia, Pa. Post Office. Copyright 1951 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Printed in U. S. A.

JOY SLUSHERS



Joy AAF-211 double-drum slusher, powered by 15 H.P. electric motor, in operation in a western copper mine, scraping into a grizzly.

Joy E-111 Turbinair tingle-drum hoist on a timber setting operation in a large western mine.

Joy HL-3 Shovel Loader mucking out a drift round in a western copper mine.

Built with JOY'S intimate knowledge of mining problems... they're scraping millions of tons of muck every year

Turbinair driven 5 H.P. S-211 slusher scraping ore in a stope in a western fluorspar mine.

Electric driven CFA-211 double-drum slusher in operation in a Tennessee zinc mine.

25 H.P. B-312 electric slusher scraping ore in a large western Canadian mine.

Ruggedly built to stay underground longer, JOY Slushers stand up under the heaviest loads and toughest conditions to give you that high efficiency found only in machines which are *designed* for the job and *proved* in the mine. Check these features: they assure more tonnage scraped per shift and longer life with less maintenance.

1. Anti-backlash brakes
2. Positive direct lubrication
3. Shield-type anti-friction bearings
4. Wide choice of pulling and tail-rope speeds
5. Universal rope guides and rope guards
6. Cast steel skid-type frames
7. Large drum diameters
8. Easily removable clutch bands
9. Simple clutch adjustment
10. Gearing enclosed for protection from dirt and dripping water

There's a JOY Slusher in a size and type for every scraping job. You need only to consult a Joy Engineer to get your answer. He can recommend the best loading equipment for your needs because Joy manufactures the only *complete* line of rock loading equipment for mines . . . slushers, track-mounted shovel loaders, and continuous-type trackless loaders.

WRITE FOR BULLETIN 76-Y

Consult a Joy Engineer

W&O M3712

1851-1951 . . . 100 YEARS OF ENGINEERING LEADERSHIP

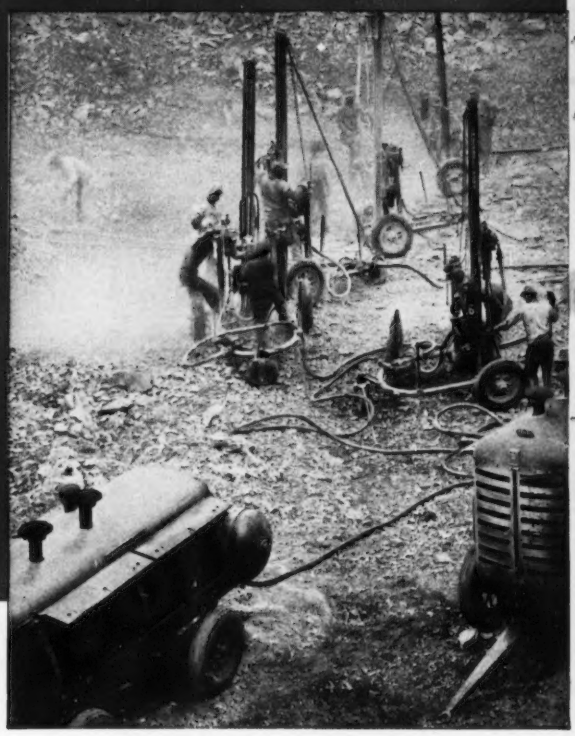
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Better air compressor ALL operating

...with TEXACO air compressor oils



Whatever your operating conditions or the size or type of your compressors, there is a Texaco air compressor oil *exactly right* to assure trouble-free and economical performance. For example—

★★ If *rust* is your problem, use a Texaco *rust-inhibited* air compressor oil. It will keep your compressors, intercoolers, aftercoolers, lines and receivers free of rust.

★★ If *carbon and gum formations* are causing trouble, use a Texaco *heavy-duty* air compressor oil with special detergent and oxidation-resistant properties. It will keep compressors clean under severest conditions.

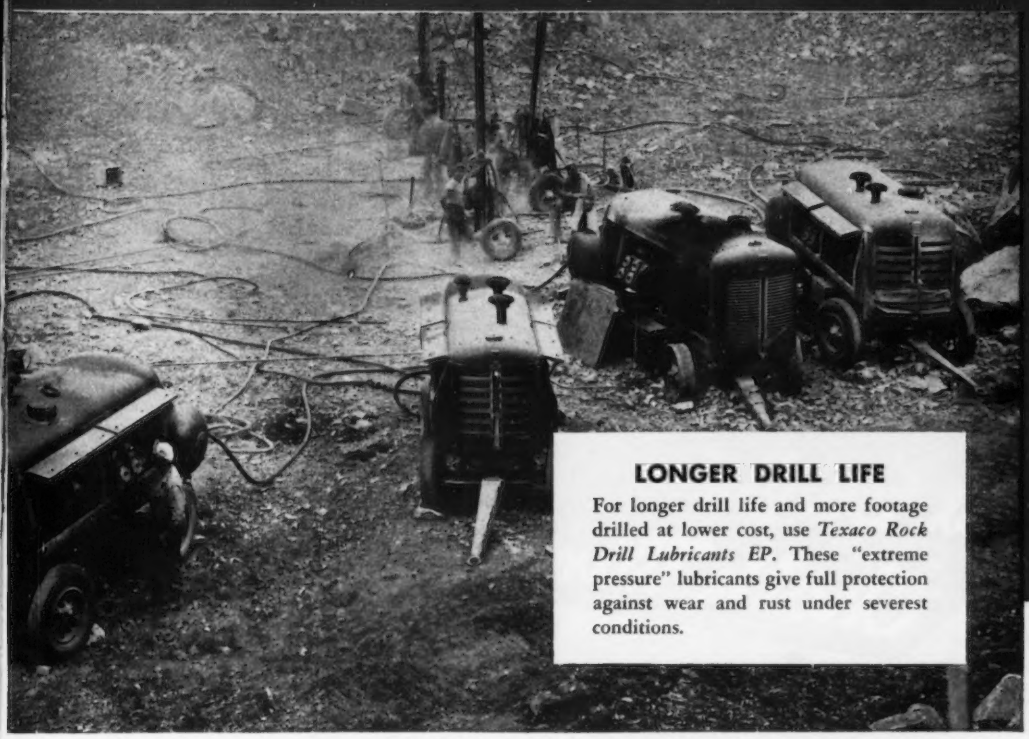
★★ If *moisture is condensing* in cylinders and washing off your lubricant, causing excessive wear, a Texaco *compounded* air compressor oil

TUNE IN...
TEXACO STAR THEATER
starring MILTON BERLE
on television
every Tuesday night.
See newspaper for
time and station.

TEXACO

TEXACO

performance under conditions...



LONGER DRILL LIFE

For longer drill life and more footage drilled at lower cost, use *Texaco Rock Drill Lubricants EP.* These "extreme pressure" lubricants give full protection against wear and rust under severest conditions.

will overcome the difficulty.

★★ If your concern is merely to assure clean operation and reduce wear under *normal conditions*, a Texaco *straight mineral* air compressor oil will do an excellent job.

A Texaco Lubrication Engineer will gladly help you select the right air compressor oil for your requirements. He'll also be glad to tell you how the Texaco Simplified Lubrication Plan enables you to handle all your major lubrication *with only six Texaco Lubricants.* Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

☆ ☆ ☆

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

Lubricants and Fuels

FOR ALL CONTRACTORS' EQUIPMENT

Here's How TOURNAPULL increased

at English Chalk Mine

At Swanscombe in Kent County, England, 110 ft. of sandy clay is being stripped in order to reach extensive deposits of chalk. An extra-capacity, 30-yd. B Tournapull is removing the top 50 ft. of overburden and large power shovels are digging out the bottom 60 ft.

1 TOURNAPULL replaces 3 crawlers

Until a year ago, Associated Portland Cement Manufacturers, Ltd., of Swanscombe, handled the preliminary stripping with a fleet of track-type tractors and 12-yd. scrapers. Despite 24-hour-a-day operation with these units, production was not sufficient to meet mill requirements. Also, because of the great depth of overburden involved, stripping costs were very high.

MAKES 11 TRIPS PER HOUR

On one-way hauls of ½ mi., the pusher-loaded 30-yd. Tournapull consistently delivers 11 heaped loads of sand and clay per hour. Cycle time averages 5.3 minutes.

This rubber-tired machine drives under its own power over both pavement and cross-country. It originally made a 35-mile trip from Staines, Middlesex, to Swanscombe through London traffic at road speeds up to 19 m.p.h.

Mail today to: **R. G. LeTOURNEAU, INC., Peoria, Illinois**

LeT

Name..... Title.....

Company.....

Street..... City, State.....

Type of work to be hauled.....

☐ Please furnish more information about your BIG Tournapulls.

Also interested in:

☐ rear-dump Tournarockers

☐ bottom-dump Tournahoppers

☐ rubber-tired Tournadozer

reduced costs, stripping output

To step up output and cut operating costs, the company brought in a LeTourneau electric-control B Tournapull equipped with a 30 cu. yd. capacity scraper. It was soon evident that this big "B", working only 2 shifts, could replace 3 crawler-scraper units, working 3 shifts. As a result, 2 Tournapull operators permanently took over the work of the 12-man tractor crew.

Moves 46,667 tons per month

In 12 months of continuous operation, the Tournapull alone has loaded, hauled and dumped 560,000 tons of overburden. Enough chalk has been uncovered for 2½ *years of mining.* Before the Tournapull was put to work, stripping was never more than *two weeks'* ahead of normal mining demands, according to Works Manager Beal.

In 4500 hours, 99% efficient

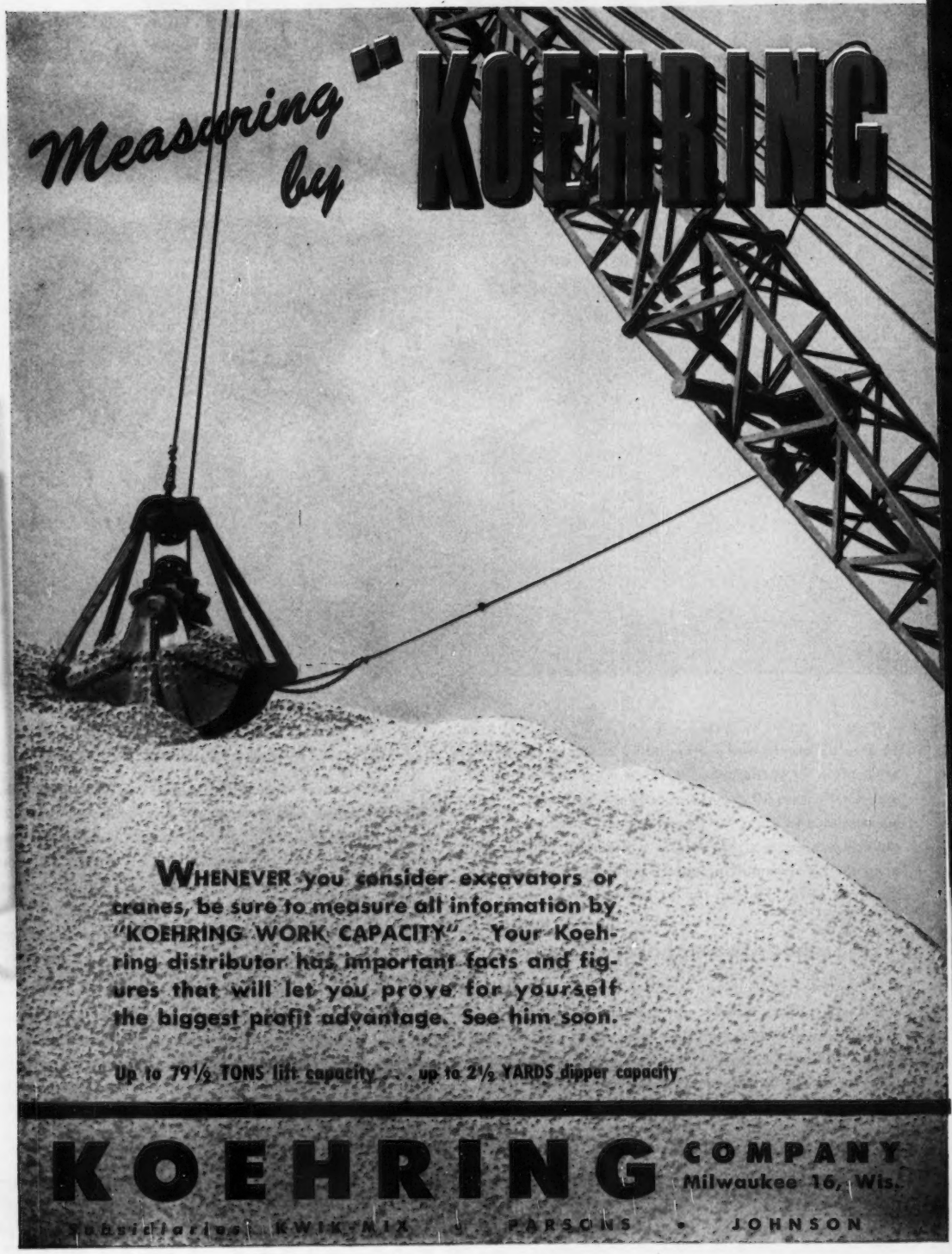
In addition, Beal reports that in 4500 working hours, the big Tournapull had been down for repairs for only 24 hours. Even though sandy clay overburden has often been water-soaked (weighing 3000 lbs. per cu. yd.), the machine is still using its original scraper control cables. Total basic cost of overburden removed (including operators' wages, fuel, lubrication, and repair parts) has been reduced to only 1½c per ton.

Consider what these savings of manpower and machine units, plus a similar increase in production, could mean on your stripping operation. Your LeTourneau Distributor will be glad to show you what these large-size Tournapulls can do on work like yours. Prompt deliveries are available. Call or write him today.

Tournapull, Tournadozer—Trademark Reg. U.S. Pat. Off. Tournarocker, Tournahopper—Trademark EX92c

LETOURNEAU PEORIA, ILLINOIS — JOB-PROVED Over 7500 Built and Shipped — TOURNAPULLS

FOR LOWEST NET COST PER YARD


Measuring by "KOEHRING"
WHENEVER you consider excavators or cranes, be sure to measure all information by "KOEHRING WORK CAPACITY". Your Koehring distributor has important facts and figures that will let you prove for yourself the biggest profit advantage. See him soon.
Up to 79½ TONS lift capacity . . . up to 2½ YARDS dipper capacity
KOEHRING COMPANY
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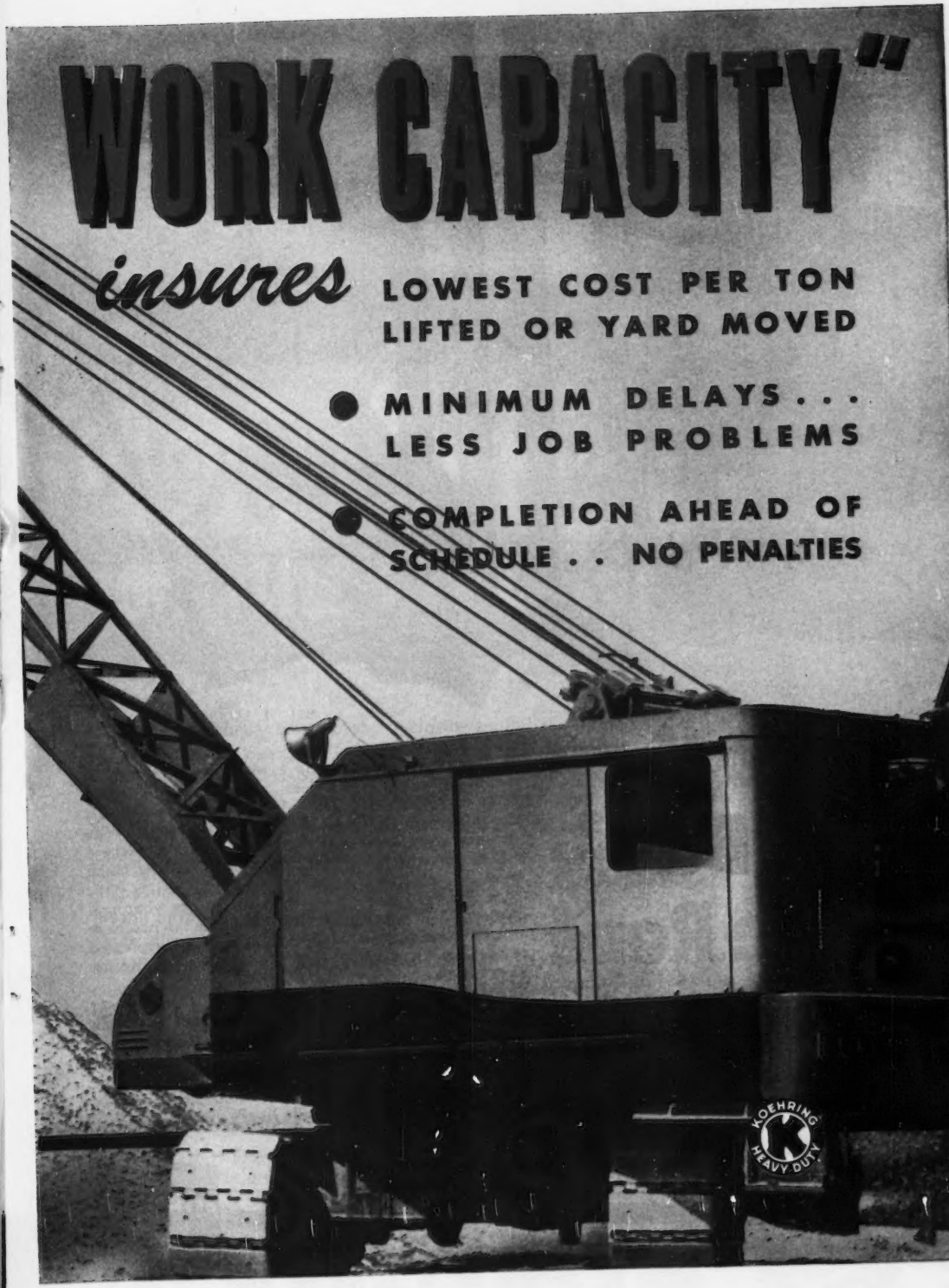
Subsidiaries: KWIK-MIX • PARSONS • JOHNSON


WORK CAPACITY"
insures
LOWEST COST PER TON LIFTED OR YARD MOVED
MINIMUM DELAYS . . . LESS JOB PROBLEMS
COMPLETION AHEAD OF SCHEDULE . . NO PENALTIES
KOEHRING
HEAVY DUTY

What's the "BEST BUY" in Wire Rope ?

The only way to determine a wire rope's value is to record the actual work it does . . . in terms of ton-miles, yards of rock moved, cars of coal hauled, etc. We'd like to have you keep such records on Bethlehem rope and any competitive ropes you may be using. Make a regular practice of it, so that you'll *know* how much each rope has done before it's scrapped.

At intervals, study these figures. They're your real yardstick of comparison. When you divide the purchase price of a rope by the total work it's done . . . expressed in tons, yards, or other units . . . the real cost of the rope becomes evident.

There's no truer method of determining today's best buy in wire rope. That's why we urge that you stack Bethlehem rope against the field and make your own comparisons—based on your own personal records.

Is there any better way of inviting you, the customer, to see for yourself? Is there any better, fairer way of laying our product right on the line?

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

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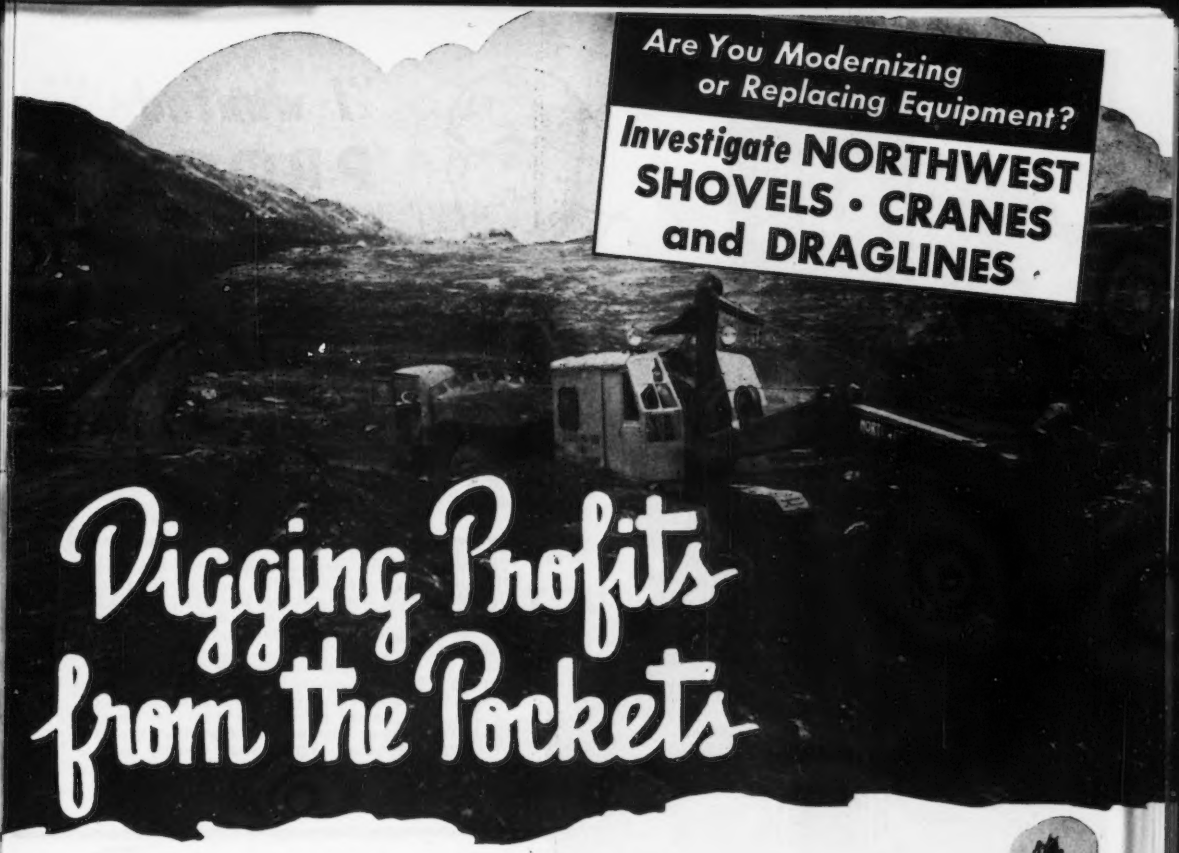
BETHLEHEM STEEL



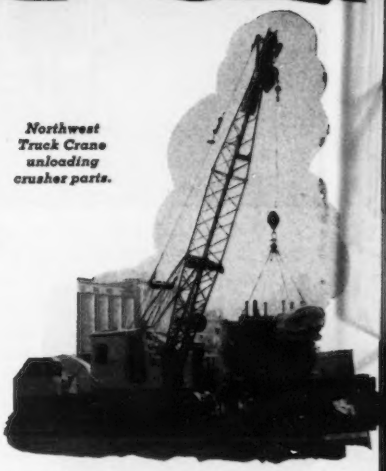
Digging Profits from the Pockets

HERE'S an unusual mining job—a Northwest Pullshovel being used in the iron ore operations on the Range to clean up rich and profitable pockets. This machine gets around easily on the mine floor, cleans out a pocket quickly and moves on to the next, doing a job the big machines pass over.

Northwests have proved themselves in a wide range of mining work.

The standard Northwest Shovel with its hard rock advantages means higher output in any rock digging. The Northwest Dragline is the solution to many overburden jobs. The Northwest Crane answers the material handling problems around the mill—and, if you need your Northwest truck mounted, there is a combination of Truck Crane and Carrier features found in no other rubber tired equipment.

You are planning equipment modernization and changes. Before buying a Shovel, Crane or Dragline, get details on Northwest equipment and what its advantages will mean to you.

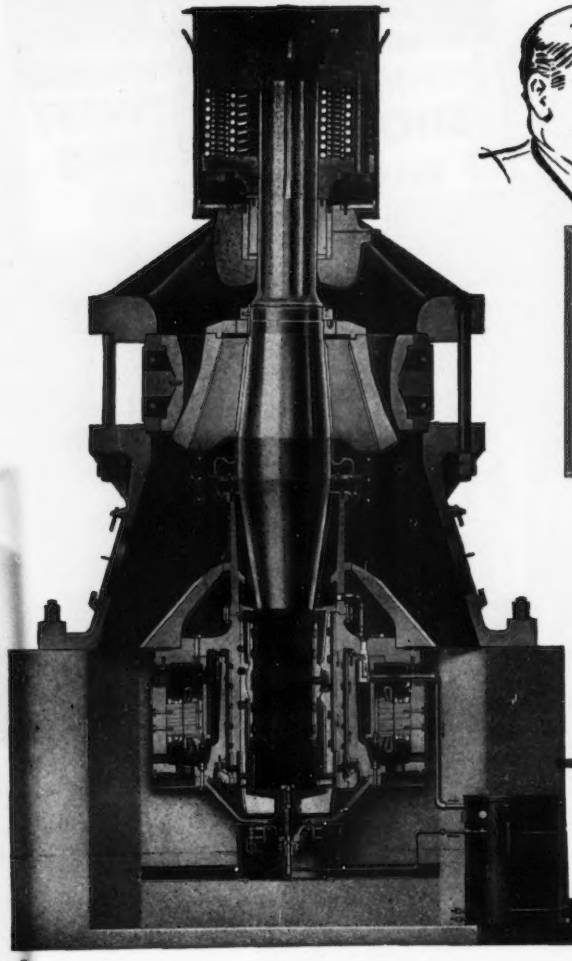


Northwest Truck Crane unloading crusher parts.

NORTHWEST ENGINEERING COMPANY
1509 Field Building, 135 South LaSalle Street, Chicago 3, Illinois

NORTHWEST

Convertible for any Mining Material Handling or Excavation Problem



"I wanted PROOF and I got it!"

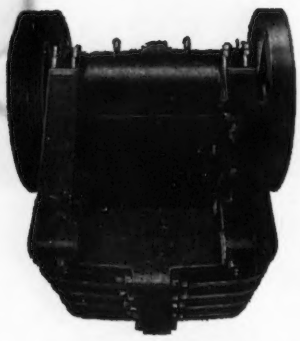
LOOK AT THESE GRADATION FIGURES ON CLOSED CIRCUIT OPERATION

99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"

The above results were obtained from four No. 37½ Kennedy type "S" Roller Bearing Gyratory Crushers. The feed opening was 6¼", the discharge 7/32". Capacity of each crusher 56 tons per hour; the power requirements of each crusher 48 h.p.

Here are the results of another test run! A Kennedy No. 37½ Crusher with a Special Grinding Ring 3" Feed Opening gave 50% more product (and a finer, better product at that) for about HALF the power cost of a competitive crusher of comparable size. With power costing say 1 cent per h.p. hour, this KVS saved some 40 h.p. (or about $11.00 daily) or around $3,000 a year. Think THAT over!

"I wanted LONG LIFE— and here's the answer!"



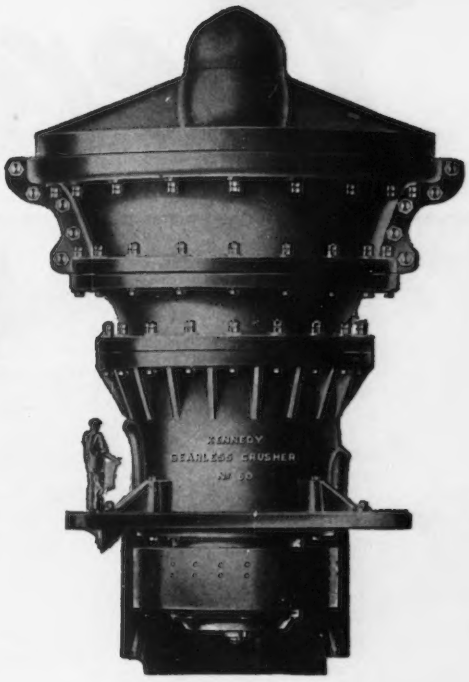
Yes Sir—if it's DOUBLE crushing life you want, remember that not only is the crushing plate in the Swing Jaw of this KVS RENEWABLE, but both Swing and Stationary jaws are interchangeable and reversible end for end. Another feature is the way the Stationary jaw takes 50% of the crushing load, resulting in a great saving in power. You can't beat any "KVS" for economy and results!

WANT PRODUCTION WITHOUT TROUBLE?

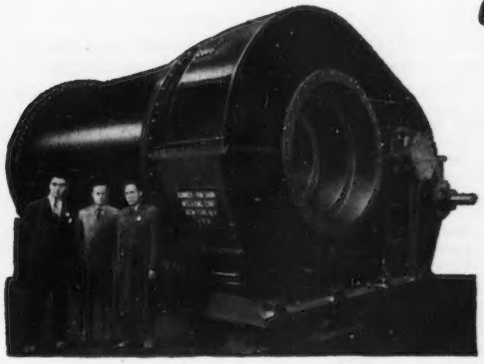
"I wanted POWER and I got it!"

Remember how the big whirling flywheel or pulley of an old Corliss Engine developed KINETIC ENERGY? That means added FREE power! The BIG Pulley in the "KVS" Gearless gives you the same result. It revolves at 3,500 ft. per minute—creates EXTRA crushing power you get free for nothing! The 11 ton pulley (used in a "KVS" Gearless Crusher weighing 400,000 lbs.) turns so easily you can turn it with TWO FINGERS! Man, when you want more CRUSHING with LESS POWER, less vibration and less NOISE, the "KVS" Gearless is the answer to your requirements.

"KVS" GEARLESS GIVES YOU ADDED FREE POWER!



"I wanted to SAVE $5,000 and I did it!"



Planning to install a tube or ball mill? SAVE $5,000—maybe more by using a "KVS" 10 ft. diameter Mill with integral gear drive with SYNCHRONOUS MOTOR DIRECT CONNECTED to driving shaft carried in roller bearings that CANNOT be misaligned or set wrong. Pinion shaft runs at about 600 r.p.m. Pinion shafts in other mills run at about 180 r.p.m. "KVS" trunnions on large sized tube and ball mills CARRIED ON OIL. Bearing never wears out, uses little power. All gears and bearings automatically oil sprayed before mill is started (design pat'd). In 15 years on this type mill no "KVS" gears or pinions have worn out.

WANT The latest KVS Bulletins? Write for them today!

YOU WANT "KVS"!

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

FACTORIES:
DANVILLE, PA., U.S.A.
CANADA, ENGLAND, FRANCE, AUSTRALIA

There's a big

This "Cat" D8 Tractor with matching blade, owned by C. Ryan & Son, is working at the open-pit molybdenum mine near Climax, Colorado. This mine produces 4,000 tons per day of molybdenum which is sorely needed for the building of our military strength.

IF YOU WANT TO HELP YOUR COUNTRY— AND YOURSELF AT THE SAME TIME— READ EVERY WORD ON THESE TWO PAGES

Keeping equipment *on the job* is of prime importance today—to the nation as well as the mining industry. With the defense effort thrown into high gear, metals are more strategic than ever. Already the United States and Canada are responsible for almost $3 billion of the world mining production (excluding coal), and an even greater effort is called for.

Right now there is a shortage of material with which to build urgently needed machines and parts. Military and Defense Rated Orders get the nod over unclassified civilian needs. Steel and other materials are in short supply. This means that you—with our help—must get every last machine-power hour out of the equipment and parts you now have.

Down-time will not only weaken the defense effort, it can mean costly delay for the mine operator too. Open-pit operations, for the critical ores, are under constant pressure for increased production. Naturally the machines that strip the ore deposits are working harder and longer. It's a situation which makes it doubly important to "baby" equipment by giving it the best care possible.

So to stay in business profitably, and help America arm for defense, do these things now:

1. Use equipment properly. "Cat" machines are built for hard use—not abuse.
2. Give *extra* attention *now* to preventive maintenance (see next page).
3. Discuss your parts needs and maintenance problems with your "Caterpillar" dealer. His maintenance responsibility begins where your operators' and mechanics' responsibility ends. He has the skilled servicemen and equipment to rework and rebuild worn parts to keep your machines on the job longer.

CATERPILLAR TRACTOR CO. • PEORIA, ILLINOIS

The last war showed the Military that "Cat" Earthmoving Equipment was as important to defense and offense as tanks. Here Sgt. Robert Chrisman operates a "Cat" D7 Tractor with matching blade on Davison airstrip at Ft. Belvoir, Va.

job ahead!

You're the Doctor

Today no owner can afford to think of direct costs alone. Good care of equipment can mean the difference between a producing machine and one laid up for repairs. To see how good care can save many hours of equipment life, reread your Operator's Instruction Book often and follow these suggestions.

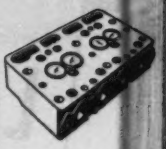
• DUST

Think of dust as Machine Enemy No. 1. A few grains today—a few more tomorrow—and soon the result adds up to serious wear. Dust or dirt plugged breathers or air cleaners—use of dirty oil containers—loose intake manifolds—loose inspection covers—dirty clutch compartment—failure to wash flywheel clutch compartment—worn seals on crankshaft—defective gaskets—failure to clean oil filter openings . . . these are some of the vulnerable spots.

• TRACK ASSEMBLY

Don't let abusive use or neglect cripple the service life of your track assembly. Track adjustment and lubrication of rollers, carrier rollers and idlers are your job. Before excessive wear occurs on grousers, links, pins, bushings, idlers, rollers and sprockets, call in your "Caterpillar" dealer. He can build up grousers, rollers, idlers and links, and replace sprocket rims and turn pins and bushings so you will have many additional hours of service.

• CYLINDER HEADS



Prevent cracked cylinder heads by avoiding overheating, freezing, scale deposits, filling a hot engine with cold water, pulling heads down too tight, and other poor maintenance practices. Your "Caterpillar" dealer can repair most cracked cylinder heads. He can replace worn valve seats with valve inserts and restore the rocker arm mechanism to serviceable limits. Consult your Operator's Instruction Book for proper cooling system and valve care.

• COOLING

Don't let your engine overheat. Keep the cooling system free of scale, rust and sediment. Use soft or treated water, and when freezing temperatures exist, protect your engine with anti-freeze. Clean the radiator regularly with chemical flushing solutions. Remove foreign matter from the core by brushing or washing. Prevent engine troubles which come with overheating. Consult your Operator's Instruction Book for proper cooling system care.

• LUBRICATION

Careful lubrication practices will add much to your satisfaction through equipment performance, economy and long life. Use *only* recommended lubricants, changing the lubricant at proper intervals. And use *only* "Caterpillar"-proved filter elements. Remove dirt from fittings and clean around the crankcase filler cap before adding oil. A little care saves many hours of engine life. Consult the lubrication chart in your Operator's Instruction Book.

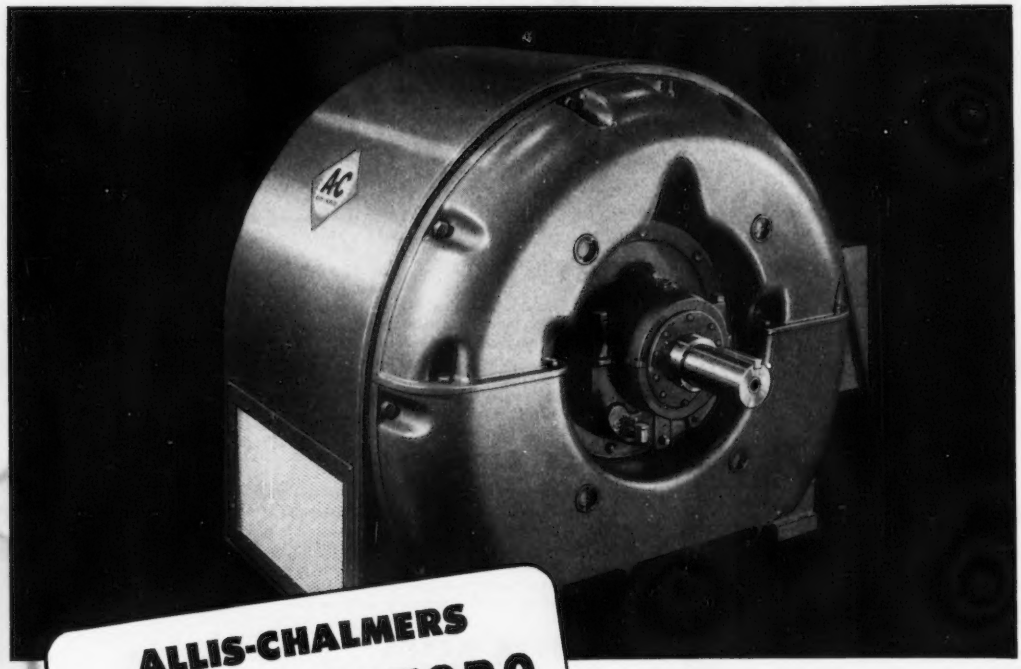
• PISTONS AND LINERS

Almost all the piston wear occurs in the upper ring groove. Your "Caterpillar" dealer can renew your pistons by machining the upper ring groove for a wide ring, many sizes of which are chrome plated. Worn liners can be deglazed and put back to work for many additional hours of service life. Consult your Operator's Instruction Book for information on lubrication and the oil cooling system.

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL ENGINES • TRACTORS • MOTOR GRADERS • EARTHMOVING EQUIPMENT



ALLIS-CHALMERS LARGE MOTORS ...Combine Protection & Accessibility

MAINTENANCE COSTS are dealt a double blow by this new line of Allis-Chalmers squirrel-cage induction motors. First, its protective design features minimize the need for maintenance operations. Then, its planned accessibility cuts the cost of doing the maintenance work.

How Maintenance is Reduced

In these motors, protection begins with drip-proof construction. But it does not end there. Air discharge openings in the stator yoke are given the added protection of removable louvered panels. Air intakes in the rigid cast iron end shields are located so as to prevent injury to the windings by mishandled tools or other objects. Capsule-type bearing housings protect the bearings and oil supply when the windings are being cleaned. The capsules can remain sealed against abrasive dirt throughout the cleaning operation.

How Costs Are Cut

This added protection has been achieved without sacrificing accessibility. One man can perform all routine maintenance operations. To check the air gap he simply removes a few screw-type plugs from the bearing end shields.

For cleaning, he removes the upper halves of the end shields and reaches right inside the motor with his vacuum cleaner or air hose. And there is plenty of room to reach up back of the stator core through the air discharge openings in the sides of the yoke.

Wide Range of Sizes

These modern-design drip-proof (or splash-proof) cage motors are built in sizes from 60 hp at 300 rpm to 2000 hp at 1800 rpm. Ask your Allis-Chalmers representative to show you the details of this exceptional new motor, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for bulletin 05B7542.

A-3409

ALLIS-CHALMERS

You can forget CUTS and ABRASION with these rugged hose twins

REDWING AIR HOSE

for rugged air service—direct connection to compressors. Goodyear's REDWING-H CORD AIR HOSE is covered with tire-tread-tough stock that's still soft and cushiony enough to resist heavy impacts—bounce away cuts and abrasion.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified REDWING-H CORD AIR HOSE

A Nonporous, seamless, flakeless tube resists lubricants in air stream

B Braids of high-strength rayon cords give extreme resistance to shock blows and tow-rope strains

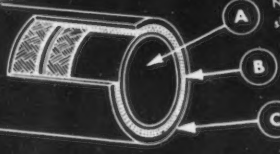
C Rugged, heavy-gauge cover resists abrasion

REDWING WATER HOSE

for heavy-duty road and building construction work. Covered with the same cushion-type stock, Goodyear's REDWING WATER HOSE gives long-lasting service in spite of impacts and abrasion. Ask about it today.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS

GTM-Specified REDWING CORD WATER HOSE



A Nonporous tube resists alkaline or slightly acidic water

B Braids of extra-strong, double-ended rayon cords

C Soft cover resists cutting, gouging and rough treatment

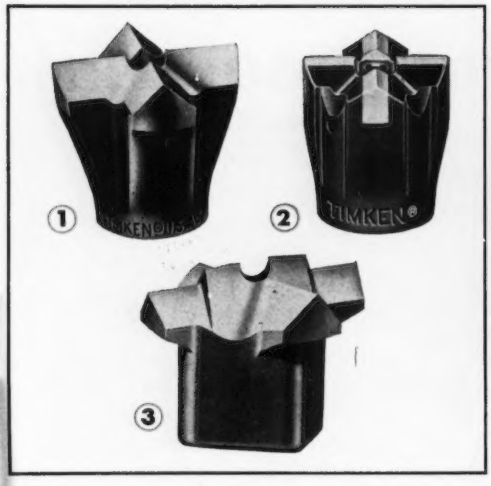
FOR HOSE, FLAT BELTS, V-BELTS, MOLDED GOODS, PACKING, TANK LINING, RUBBER-COVERED ROLLS *built to the world's highest standard of quality, get in touch with the G. T. M.—Goodyear Technical Man—or phone your nearest Goodyear Industrial Rubber Products Distributor.*

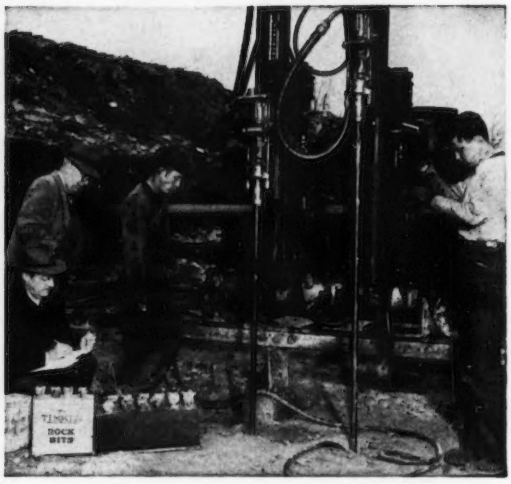
GOODYEAR

THE GREATEST NAME IN RUBBER

Redwing—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Only the Timken Company offers all 3 rock bit types...





and a complete engineering service

1 MULTI-USE. Basic removable rock bit for 18 years. Gives lowest cost per foot of hole when full increments of the steel can be drilled and when all bits are returned for reconditioning. Low cost.

2 CARBIDE INSERT. For extremely hard and abrasive ground, small holes, extra deep holes. Lets drillers spend more time drilling—less time changing bits. Holes go down faster. Bit reconditioning is simplified.

3 ONE-USE "SPIRALOCK". For use where reconditioning is impractical or undesirable. Offers lowest unit bit cost. New "Spiralock" union holds bit dependably—permits easy removal. Simplifies steel preparation.

The Timken Company's Rock Bit Engineering Service is always ready to help you with your rock bit problem and to help select the right bit for your job. With more than 17 years' experience and *all three* rock bit types to choose from, our Rock Bit Engineering Service can assist you in getting the bit performance you need—whether it's lowest cost per foot of hole, lowest unit bit cost, greatest possible drilling speed, or any other desired advantage.

No other company offers this complete service. Because only the Timken Company makes *all three* rock bit types, our engineers can give you an unbiased recommendation as to the best bit for your job. And no other manufacturer of rock bits has had as much drilling experience in mining, quarrying and construction as the Timken Company. The Timken Roller Bearing Company, Rock Bit Div., Canton 6, O. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

your best bet for the best bit ... for every job

FREE BOOKLET! A valuable guide for every rock bit buyer. Shows full line of bits with detailed descriptions, recommended uses. Write The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

"Handiest Little Crane We've Ever Seen Around A Mine"

Hydrocrane Users Report

Here an H-3 stockpiles mine timbers. Additional attachments include crane hook, magnet, car cleaning bucket, grapple and materials handling bucket.

Mine operators are quickly sold on the all-round value of the truck-mounted Bucyrus-Erie Hydrocrane. They report surprising time and money savings on countless digging, lifting and material handling jobs formerly done with makeshift rigs and costly hand labor.

Every Hydrocrane work function is fully hydraulic. Loads can be moved a fraction of an inch if needed—a big safety factor when working around people and in close quarters. Two Hydrocrane sizes — 2-ton ¼-yd., 3-ton ⅜-yd. Find out more about this multi-job crane. Send the coupon now.

HYDROCRANES HANDLE ALL THESE MINE JOBS — AND THEN SOME

- Load timbers to mine cars from truck, stockpile or gondola car
- Erect and dismantle conveyor machinery
- Stockpile and rehandle sand, cinders, gravel and building materials
- Dig trenches, clean out drainage ditches, excavate for foundations
- Unload mine tracks, pipe, miscellaneous supplies, motors, machinery
- Remove snow
- General utility work
- Cleaning up ore spillage
- Loading coal
- Cleaning cars

Speed Shaft Mucking With New Hydromucker

Now, a fast, mechanized way to remove muck in shaft sinking work — the Bucyrus-Erie Hydromucker. Unit consists of hydraulically operated ⅜-yd. clamshell bucket, hydraulic pumps, electric motor and control bank. Bucket loads material from shaft floor to skip, car or other suitable conveyor for removal to the surface. Owners report 35% faster mucking with 30% less manpower by using the new Hydromucker.

BUCYRUS-ERIE HYDROCRANE DIVISION

South Milwaukee, Wisconsin

BUCYRUS ERIE HYDROCRANE
South Milwaukee, Wisconsin

Gentlemen:

☐ Please send Hydrocrane bulletins to
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Company.....

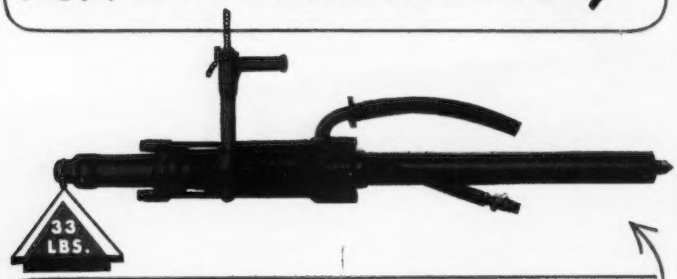
Address.....

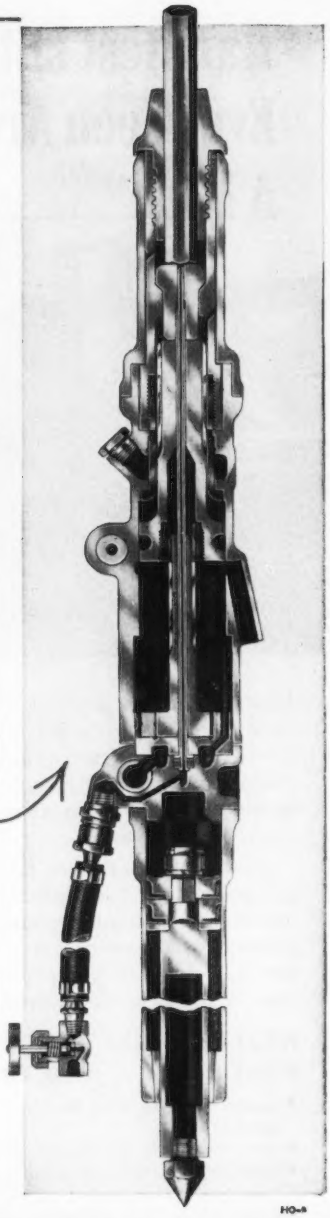
City.....State.....

110MS1

HERE'S PROOF THAT

Only Blue Brute Stopers Handle So Easily... Perform So Economically!





BETTER BALANCE

A Blue Brute EXCLUSIVE

If you've never realized before how much stopers differ in the vital matter of *balance*, look at the results of this simple test, made on the Blue Brute Self-Rotating WR–31 and its two leading competitors. When the three stopers were suspended by their handles, the following weights on the chucks were required to bring each chuck to horizontal:

Blue Brute	**— 33 lb.**
Stoper A	**— 24 lb.**
Stoper B	**— 0 lb.**

With its operating handle set well above the center of gravity, the Blue Brute WR–31 has by far the *best working balance* for easy handling. Wrestling with a top-heavy stoper slows a runner down, sends your costs up. Give him a *correctly balanced* WR–31 and he'll make up for lost time!

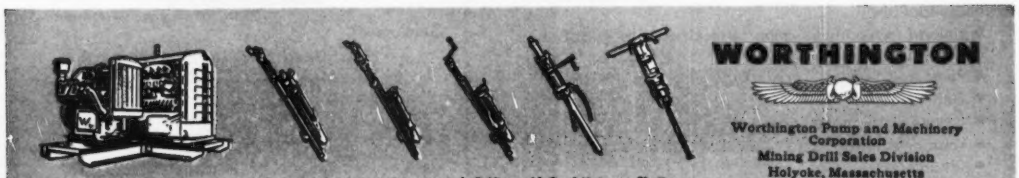
POSITIVE-ACTING VALVE

A Blue Brute EXCLUSIVE

Sleeve-type, with large bearing surfaces, for minimum wear over extra-long service life. The leakproof end seats improve with age, while circumferential laps keep air from reaching both ends of the piston hammer at any stage of the cycle. And the port thrown valve both ways assures positive action on the hammer on both forward and rearward strokes. Typical of Worthington leadership in rock drill design, this jet valve keeps the WR–31 drilling faster and cleaner on very little air!

Many other WR–31 advantages . . . like the shielded, down-directed exhaust, and the constant air stream keeping sludge and water out of the shielded chuck . . . mean your runners can drill easier, faster, more profitably for you on every job. . . . Let an on-the-job demonstration prove to you that **there's more worth in a Blue Brute.** ***And write for literature describing the complete line of Blue Brute Mining Equipment.***

BUY BLUE BRUTES



Semi-Portable Compressors. Drifters with Feed Motor Incorporated. Drifters with Feed Motor on Shell. Hand-Crank Drifters. Stopers. Hand-Held Rock Drills.

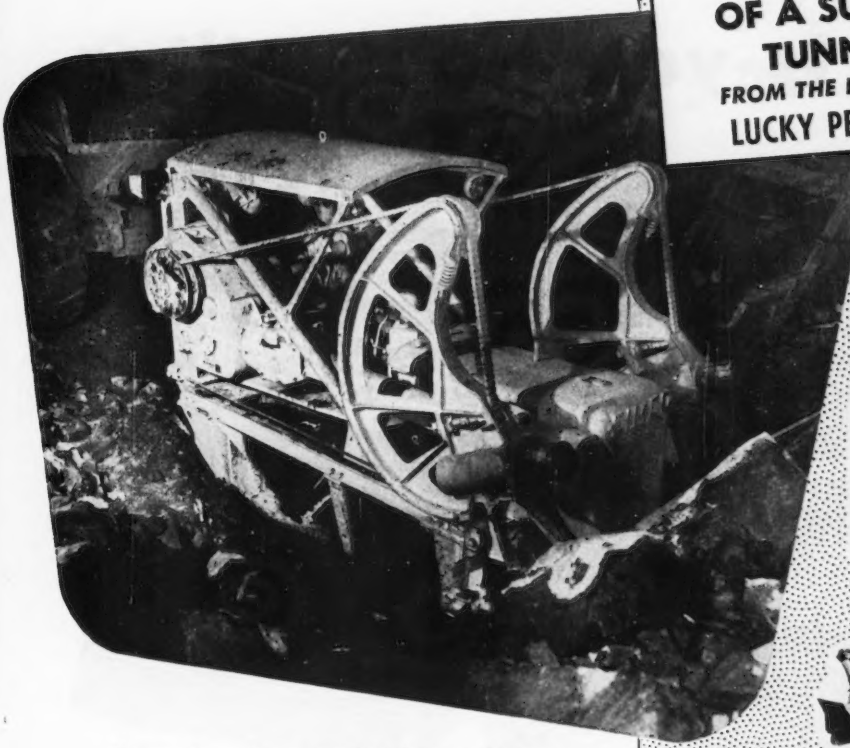
WORTHINGTON

Worthington Pump and Machinery Corporation
Mining Drill Sales Division
Holyoke, Massachusetts

CASE HISTORY OF A SUCCESSFUL TUNNEL JOB

FROM THE EIMCO FILE T256

LUCKY PEAK TUNNEL



Specifications

Lucky Peak tunnel 1140' long. Diam. 29'6" inside circular steel sets. Average round 8' deep. Mucking time 3 hours. Mucking machine — Eimco 104 RockerShovel.

Big tunnels, such as railroad, highway and hydro-electric tunnels, are increasing in number every day—they are always a real challenge for the engineer and the contractor.

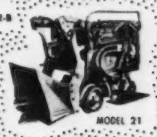
Equipment for these jobs is usually designed for each project—rarely had a contractor been able to find any machine versatile enough to load efficiently in more than one of these tunnels.

Now for loading in these big bores the contractor has found that it can be handled by a standard machine, the Eimco crawler mounted RockerShovel.

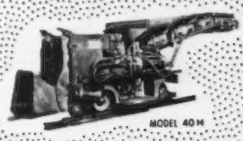
The Eimco 102 and 104 will quickly and efficiently load out the toughest muck piles in the shortest period of time. These machines have the advantages of mobility, small space, digging below grade for steel sets and many other exclusive features.

Write for more information.

MODEL 12-B

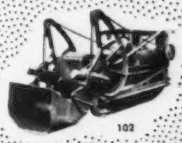


MODEL 21



MODEL 40 H

MODEL 15



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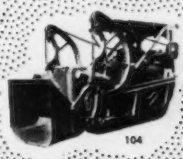

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EIMCO

THE EIMCO CORPORATION

The World's Largest Manufacturers of Underground Rock Loading Machines

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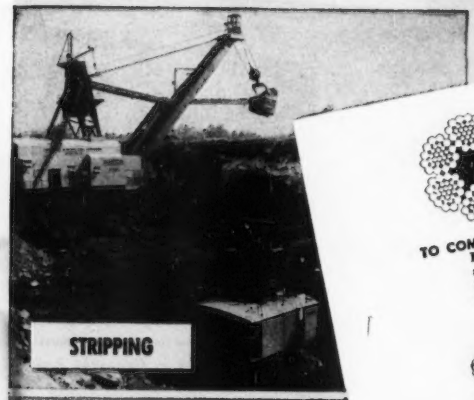
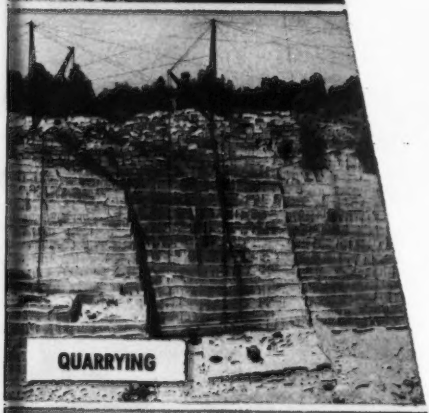
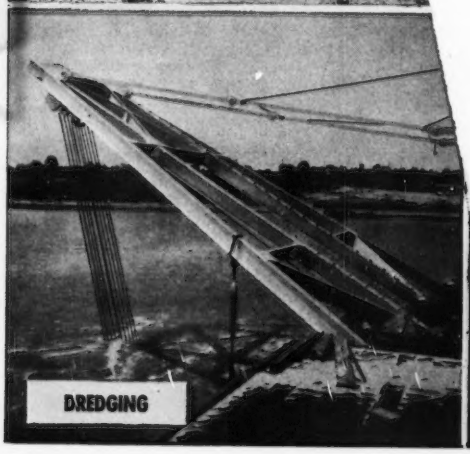
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

Is your competitor





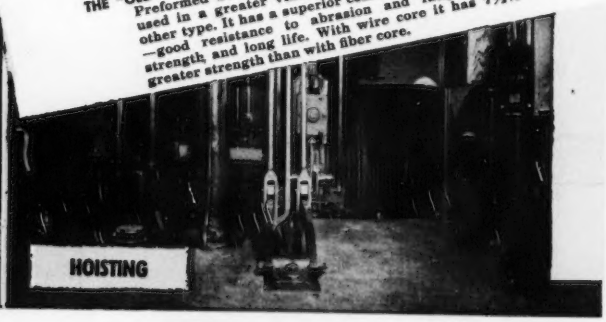


TO COMBAT SEVERE ABRASION American Tiger Brand 6x30 Type G, Excellay Flattened Strand Lang Lay. This rope has a larger metallic area than round strand ropes, greater strength, greater resistance to abrasion and high resistance to crushing. Without doubt, you will get longer service and lower wire rope costs if you use it.

TO COMBAT FATIGUE Tiger Brand 6x37—Type S Excellay Preformed. This rope is listed as "Special Flexible Hoisting Rope" and is also known as "Crane Rope." It is the most flexible of standard constructions which permits its use with small sheaves and drums. Its reserve strength is highest of the standard constructions.

FOR RESISTING CRUSHING Tiger Brand 6x19 Seale Patent Excellay Monitor Preformed IWRC. Here's a rope that is widely used where resistance to crushing is necessary. It stands up under heavy abrasion, yet has sufficient flexibility for winding on medium sized drums.

THE "OLD WORKHORSE" Tiger Brand 6x19 Type N Excellay Preformed Standard Hoisting Rope is more widely used in a greater variety of applications than any other type. It has a superior combination of qualities —good resistance to abrasion and fatigue, high strength, and long life. With wire core it has 7½% greater strength than with fiber core.



SMARTER than you?

You may be paying double

his wire rope costs unless you follow a few simple rules

The wrong wire rope on a job where abrasion or fatigue is severe has been known to cut service life in half . . . and careless handling or just plain abuse will result in similar short service. To get the best wire rope for your job, you should consider these four major requirements carefully—

1. **Is it strong enough to take care of any load that may be applied, with a proper factor of safety?**
2. **Does it have the ability to withstand repeated bending without failure of the wires from fatigue?**
3. **Will it withstand abrasive wear?**
4. **Can it take crushing?**

A proper choice is made by correctly estimating the relative importance of each quality and selecting a rope that has the best combination of properties for your application.

HOW THE TIGER BRAND SPECIALIST CAN HELP YOU

It is obvious that *one or even a few* types of wire rope can't meet all conditions. What's more, the average user can't be an authority on wire rope. That's why it's so important to use the engineering knowledge of a man who has made wire rope application his life work. The Tiger Brand Wire Rope Specialist can analyze your problems and recommend the best rope to fit your needs.

American Steel & Wire Company
Rockefeller Building, Dept. C-6
Cleveland 13, Ohio

Please send me your 128-page handbook, "American Tiger Brand Wire Rope."

Name.....

Company.....

Address.....

City.....Zone...State.....

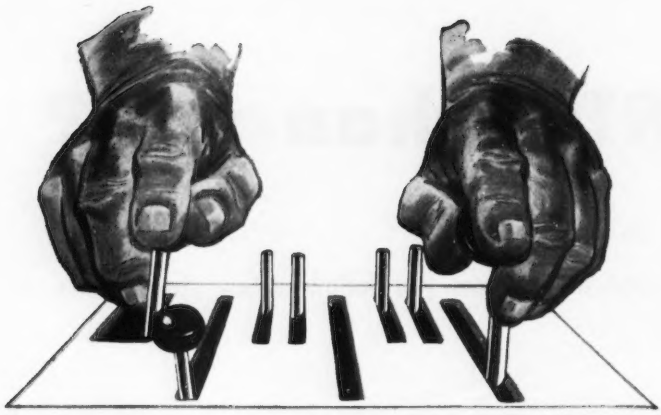
AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO • COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS • UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL



At your fingertips . . . up to 25% increased output with

SMOOTHER, EFFORTLESS, *Speed-o-Matic* CONTROLS

Fingers instead of muscles do the work with Link-Belt Speeder's exclusive Speed-o-Matic* controls! Every move of Shovel-Crane is faster, more accurate, easier. You get "pin point" placement of bucket, shovel or hoe. No drag or lag, jerk or jump. You "feel the load" every inch of the way—smoothly, surely, safely.

As for your operator, what a difference this control makes! He's fresh and fit, even during long overtime. And he lifts, loads and swings with a tireless precision that pays off in greater output, more profits for you.

Only Link-Belt Speeders offer you the unequalled advantages of Speed-o-Matic *full* hydraulic controls. Look to Link-Belt Speeder for more work, more kinds of work, more of the time.

* On 51, 300 and 500 series.

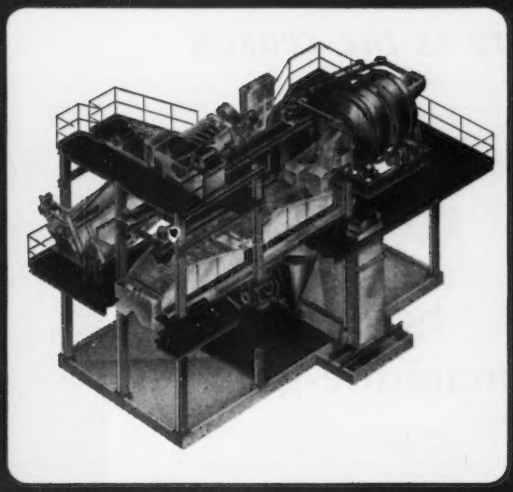
K-595 stripping overburden
Tremendous power, stability and swift, easy Speed-o-Matic control makes this K-595 ideal for high output in mining operations. In dragline work the Independent Rapid Boom Hoist, powered both up and down makes long throws, fast hoisting and swinging simple routine. Rugged construction assures low maintenance.

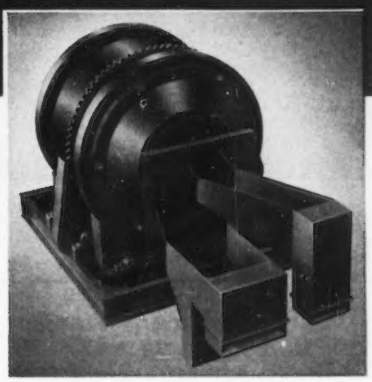
12.371

LINK-BELT SPEEDER
CORPORATION

Builders of the most complete line of shovels, cranes and draglines
CEDAR RAPIDS, IOWA

WITH **WEMCO'S** NEW
DRUM SEPARATORS





7 MOBIL-MILL ADVANTAGES

- *Prefabrication*
- *Low initial cost*
- *Clean, sharp separation*
- *Fast Wemco erection*
- *Compact design*
- *Low operating cost*
- *Capacities, 5 to 275 T P H*

• THE SINGLE DRUM SEPARATOR

For one stage Heavy-Media Separation, the single drum provides positive sink removal, low attendance requirements, close control of media density and lower horsepower consumption.

Sink material is removed by integral lifters in the rotating drum; the float material overflows the drum discharge weir. A minimum of media is carried over with the products, decreasing the investment in media reclaiming equipment.

• THE DOUBLE DRUM SEPARATOR

In treating those ores where a middling component must be segregated, Heavy-Media Separation can now accomplish this added separation with new economy and **positive gravity control.** The **WEMCO** Double Drum Separator uses a medium at two different gravities in separate compartments. Two stage separation is gained with decreased capital outlay and lower operating costs.

In a typical operation, feed is received by the first compartment which overflows a true float product and sends sink material directly to the second compartment. There a heavier gravity medium floats the middling product and submerges the true sink.

Both the true sink and true float are purer products than those produced by single stage operation, and the middling is cycled to recrushing and further separation.

Write today for further information on **WEMCO** *Mobil-Mills and drum separators.*

WEMCO

760-766 FOLSOM STREET · SAN FRANCISCO 7, CALIFORNIA

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MOBIL-MILLS
COAL SPIRALS
HMS THICKENERS
HMS PUMPS
DENSIFIERS
CONE SEPARATORS
DRUM SEPARATORS
FAGERGREN & STEFFENSEN FLOTATION MACHINES
FAGERGREN LABORATORY UNITS
HYDROSEPARATORS
HMS LABORATORY UNITS
DEWATERING SPIRALS
AGITATORS
S-H CLASSIFIERS
THICKENERS
SAND PUMPS
CONDITIONERS

Here is the reason

behind machine-gun camera photos like this

BLAST!

Yes, this is a BLAST—and a good one, too! You see no puffs of wasted explosives gas or wild flying rock! And it's the *peak* of the blast. The rock has moved out 30 to 40 feet from the face, and is ready to drop in a well-broken heap, ready for the shovel.

We've taken hundreds of these pictures, showing several types of blasting—clicked off by our electric machine-gun camera at the rate of three per second. The reason behind them is to show what *really* happens when a blast goes off—so that you, our customer, can profit from better knowledge of results to be gained from different explosives, different loading and shooting methods.

This photo, for example, is one of 15 covering this blast of 22,000 pounds of Atlas explosives in a limestone quarry. It shows the ROCKMASTER Blasting System at its best. All 17 holes were detonated from the bottom, alternating ROCKMASTER electric detonators No. 1 and 2 (timed at average 17 milli-seconds apart).

Ask your Atlas representative to show you machine-gun camera photos of other types of blasting, so that you can gain from Atlas' wide experience in pioneering split-second delay blasting. Ask him, too, or write us, for the ROCKMASTER Booklet, showing typical loading diagrams for blasting rock, coal, ore . . . on the surface or underground.

Less Bark *More Bite*

ROCKMASTER "16" TIMINGS

Rockmaster No.	Avg. Time of Each Delay from Zero (milli-seconds)
0 (zero)	0 (inst.)
1	8
2	25
3	50
4	75
5	100
6	125
7	150
8	175
9	200
10	250
11	300
12	350
13	400
14	450
15	500
16	550

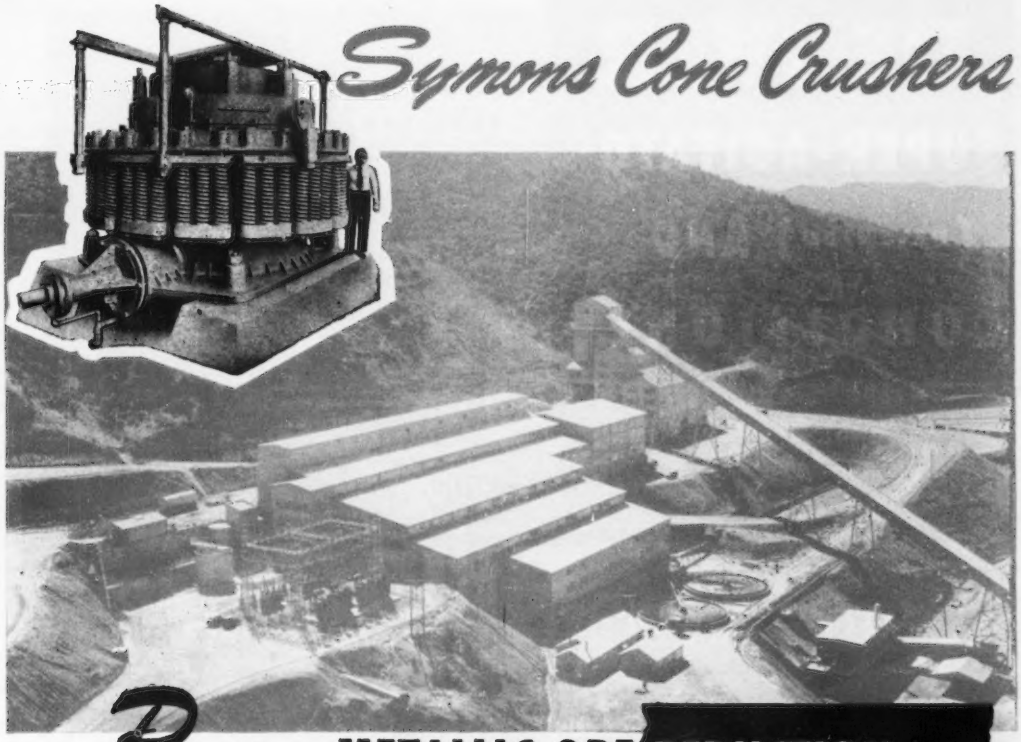
ROCKMASTER: Reg. U.S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

Symons Cone Crushers



. . . Proved in METALLIC ORE REDUCTION

Finer Crushing—Greater Capacity—Uniformly Sized Ball Mill Feed have won for the Symons Cone outstanding leadership in the reduction crushing field. This is evidenced by their repeated use for metallic ore reduction. Built in Short Head and Standard models and in capacities up to 900 tons per hour, there is a type and size for every crushing need. When your operations involve fine crushing, follow the leaders in the metal mining industry who are doing their reduction crushing with Symons Cones.

- BISMUTH
- CADMIUM
- CHROMIUM
- COPPER
- GOLD
- IRIDIUM
- IRON
- LEAD
- MAGNESIUM
- MANGANESE
- MERCURY
- MOLYBDENUM
- NICKEL
- PLATINUM
- RADIUM
- SILVER
- TITANIUM
- TIN
- TUNGSTEN
- URANIUM
- VANADIUM
- ZINC

NORDBERG MFG. CO.
MILWAUKEE 7, WISCONSIN
NEW YORK • SAN FRANCISCO • WASHINGTON • SPOKANE
MEXICO, D. F. • LONDON • TORONTO • JOHANNESBURG

NORDBERG
Machinery for processing ores and industrial minerals

DENVER SUPER-AGITATOR (PATENTED) AND CONDITIONER

FOR TOUGH PROBLEMS IN

Agitating	Mining
Aerating	Milling
Mixing	Processing
Blending	Chemical
Conditioning	Industrial
Scrubbing	Food
	Foundry

EVERY PARTICLE MIXES

Feed normally enters directly into the standpipe top . . . is sucked down and is positively mixed by the propeller at the lower end. Thus, there can be **no** short circuiting of pulp as every particle is thoroughly agitated and mixed.

FEED LOW...DISCHARGE HIGHER

A feed port is available directly to the lower end of the standpipe. Since discharge is at a higher point, an actual gain in elevation can be had for series applications.

EVERY PARTICLE RECIRCULATES

Pulp movement in the tank is constantly toward the adjustable central standpipe due to the sucking and mixing action of the propeller and the resulting controlled vortex down the standpipe. Intermediate recirculation ports may be opened or closed depending on the treatment process.

NO SANDING UP

For intermittent operation or between shifts, there is no problem of "digging out" as the replaceable alloy iron standpipe flange prevents "sanding in" of the propeller.

SIZES 3' x 3' to 20' x 20'

Write for Deco Bulletin A2-B2, containing detailed information and pulp density charts for calculating size required.

FLOTATION ENGINEERS

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

"The firm that makes its friends happier, healthier and wealthier"

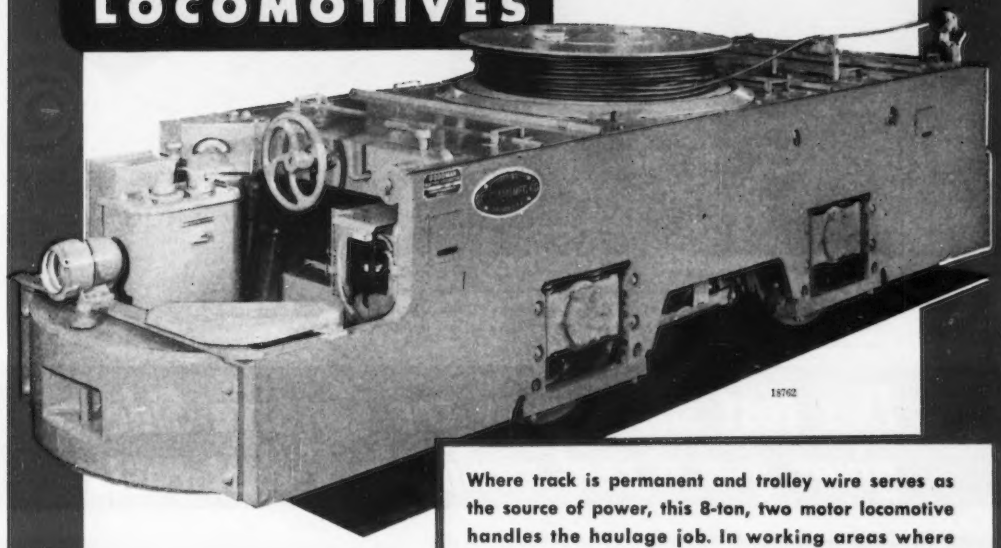
DENVER • NEW YORK • CHICAGO • EL PASO • VANCOUVER • TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

DENVER EQUIPMENT COMPANY, 1402 17th St., Denver 17, Colorado

FOR CONTINUOUS SERVICE
WHEREVER THERE'S TRACK
USE

Goodman
TROLLEY-REEL LOCOMOTIVES

EFFICIENCY—
HIGH
OPERATING COSTS—
LOW



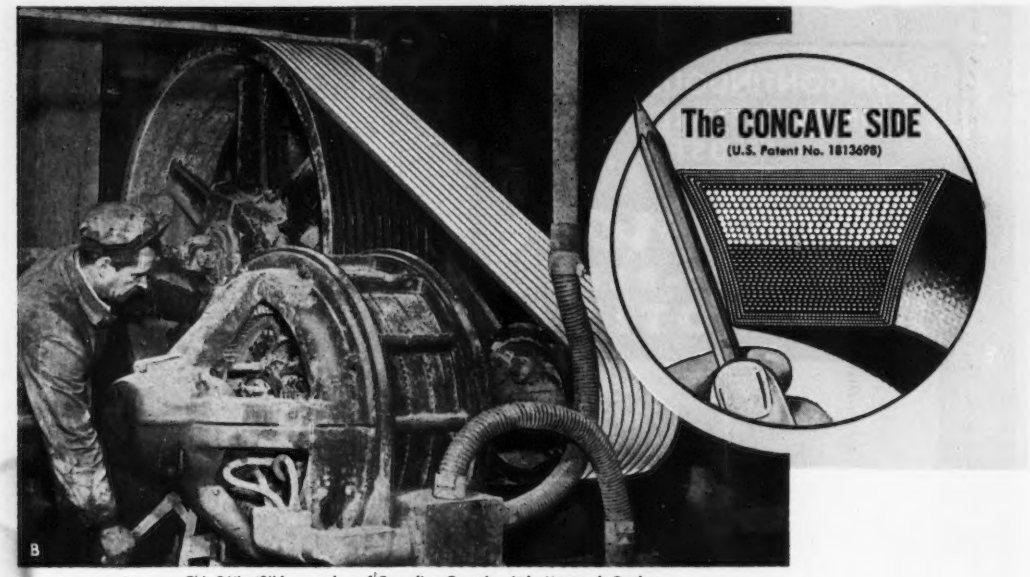
Where track is permanent and trolley wire serves as the source of power, this 8-ton, two motor locomotive handles the haulage job. In working areas where track is temporary and it is inadvisable to extend the trolley wire because of loading chutes, extremely wet conditions or bad roof, this same locomotive operates from the cable reel.

FEATURES OF THIS METAL MINE LOCOMOTIVE

- Transverse equalizers for smooth performance on all types of track
- Roller bearing axle journals
- Accessible brake rigging
- Sand boxes filled from outside frame
- Two 40 hp. motors
- Over-all height 49½", width 53½", length 14'10"
- 24" to 36" gauge, 60" wheelbase
- Selective series or parallel camtactor type controller

When production costs are being analyzed, it will pay you to check details of your transportation system. Let a Goodman sales engineer help you.

Goodman MANUFACTURING COMPANY
HALSTED STREET at 48th • CHICAGO 9, ILLINOIS



This 36"x 42" jaw crusher of Canadian Quarries, Ltd., Montreal, Quebec, used to be driven by a double reduction flat belt drive. Mr. Pierre Manseau, Master Mechanic, says that the Gates Vulco Rope Drive shown, "has reduced our maintenance costs by about $1000 per year and we were also able to increase production by fifty tons per hour."

This test shows how the Concave Side gives you a real saving in V-Belt costs

If you are interested in lower operating costs, make this simple test:—

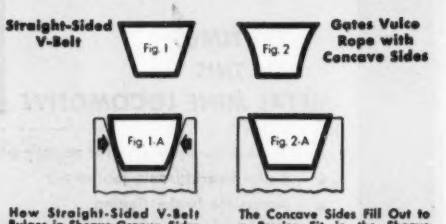
Take *any* V-belt and bend it as it bends in going around a pulley. As the belt bends, grip its sides with your fingers and thumb. You will *feel* the sides of the belt *bulge out!*

This bulging gives a straight-sided V-belt the shape shown in figure 1-A. (See diagrams at right.) Clearly, this shape does not fit the sheave groove. The sides of the bulging belt are forced to press unevenly against the V-pulley—and this concentrates the wear along the *middle* of the sides.

But when you bend a V-belt that is built with the *Concave Side*, you find that the sides become perfectly straight—as shown in Figure 2-A. This shape precisely fits the sheave groove.

Because there is *no bulging*, the sides of the Gates Vulco Rope always grip the *full* face of the V-pulley *evenly* and therefore wear *uniformly*—resulting in *longer belt life* and *lower belt costs for you.*

What Happens When a V-Belt Bends



How Straight-Sided V-Belt Bulges in Sheave-Groove. Sides Press Unevenly Against V-Pulley Causing Extra Wear At Point Shown by Arrows.

The Concave Sides Fill Out to a Precise Fit in the Sheave Groove. No Side Bulge! Sides Press Evenly Against the V-Pulley—Uniform Wear—Longer Life!

Only V-belts made by Gates are built with concave sides. Whenever you buy V-belts, be sure you get the V-belt with the Concave Sides—The Gates Vulco Rope!

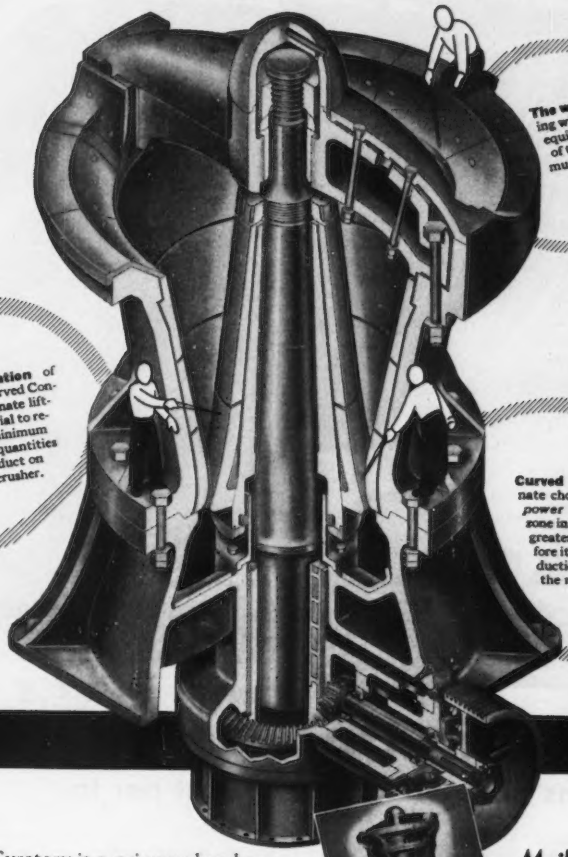
CS-514

Gates®
Hose V-Belts
Molded Rubber Goods
for Industry

VULCO ROPE DRIVES
ENGINEERING OFFICES AND JOBBER STOCKS
IN ALL INDUSTRIAL CENTERS

THE GATES RUBBER COMPANY
DENVER, U. S. A.
The World's Largest Makers of V-Belts

Here's why a Traylor TC Gyratory Produces so much at so little cost



The wide angle of the feed opening will team up with your heaviest equipment to permit reduction of the largest rocks with a minimum of preliminary breaking.

By the efficient application of crushing force, Traylor's Curved Concaves and Bell Head eliminate lifting and churning of material to reduce waste fines to a minimum . . . . . produce greater quantities of uniform cubical product on the first pass thru the crusher.

Curved Crushing surfaces eliminate choking and packing . . . *and power waste.* Each succeeding zone in the crushing chamber has greater capacity than the one before it. Steady, dependable production without interruption is the result.

The Traylor TC Gyratory is a primary breaker of great efficiency and huge capacities. Its overall sturdiness of design provides adequate mass for shock absorption. It's a big crusher built to do a big job. Any plant of 10,000 tons daily capacity or over will operate at greater efficiency with a Traylor TC Gyratory. Free bulletin gives complete details . . . sizes . . . capacities. Mail coupon for your copy today.

Mail Coupon for Full Information

TRAYLOR ENGINEERING & MANUFACTURING CO.
354 MILL ST., ALLENTOWN, PA.

Give me the details on a Traylor TY Gyratory Crusher . . . especially on its economical operation.

*Name*_____

*Company*_____

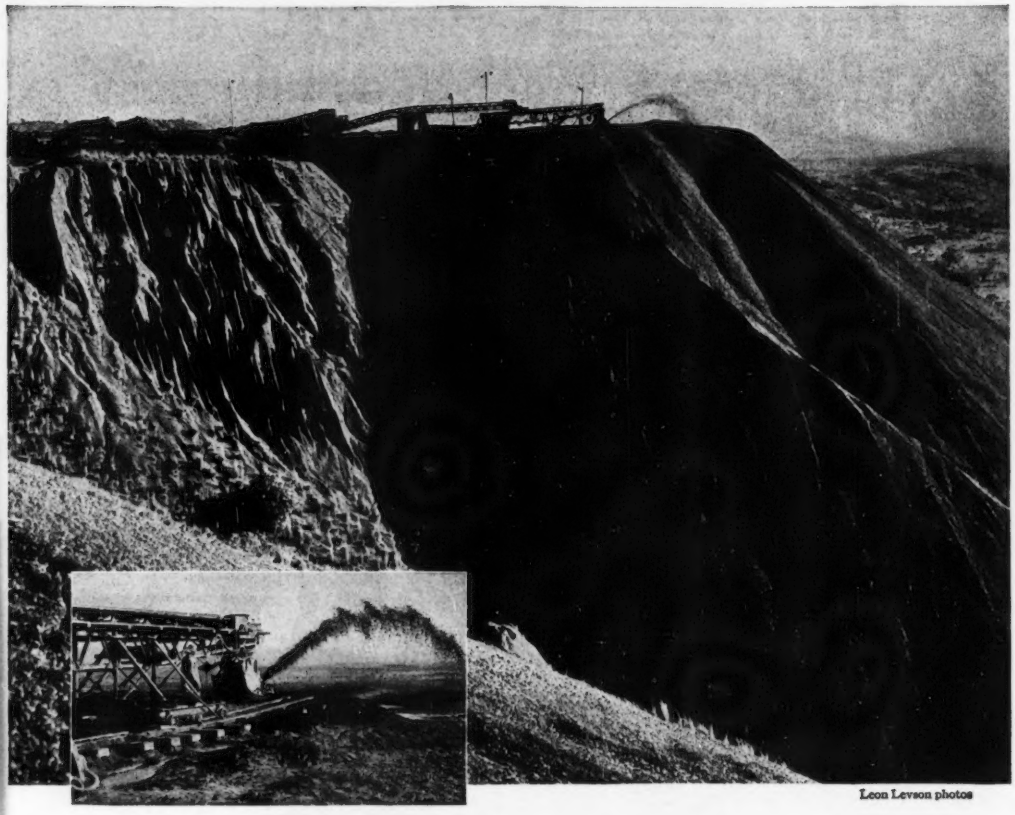
*Address*_____

SALES OFFICES: New York, N.Y.; Chicago, Ill., Los Angeles, Calif.
Canadian Mfrs: Canadian Vickers, Ltd, Montreal, P.Q.

Traylor

Rotary Kilns, Coolers and Dryers • Grinding Mills
Jaw, Reduction and Gyratory Crushers • Crushing Rolls

A "TRAYLOR" LEADS TO GREATER PROFITS



Leon Levson photos

Mountain Under Construction

—700 tons an hour—at lowest cost per ton

To recover a single pound of diamonds about 15,000,000 lbs. of earth must be moved. Disposal of tailings is in itself a huge job—and cost-per-ton becomes a prime factor in profitable operations. This was the condition S-A engineers and Fraser & Chalmers (SA) Ltd., met in designing the conveying system that "built" the mountain you see above.

S-A equipment and 50 years of S-A engineering experience, have combined to produce a handling system that has fulfilled every expectation by moving enormous quantities of material at very low cost per ton. The flexibility of the system enables it to be extended easily and economically as needed.

If *you* have a bulk materials handling problem, let an S-A engineer show you what S-A can do to provide a *cost-reducing* solution. Write for a survey. No cost or obligation.

PREMIER DIAMOND MINE
Cullinan, Transvaal,
Union of South Africa

An S-A Centrifugal Thrower Unit mounted at the end of a Shuttle Belt Conveyor throws tailings out over the dump pit in a trajectory of 50 to 60 feet. The thrower can handle approximately 700 tons per hour and can be swiveled to aim in any direction. As the dump face builds up, the conveyor system is easily extended. (In addition to tailings disposal, all other handling operations in the entire recovery plant have been mechanized with S-A equipment.)

1901-1951

50 years experience with bulk handling

STEPHEN S-A ADAMSON MFG. CO.

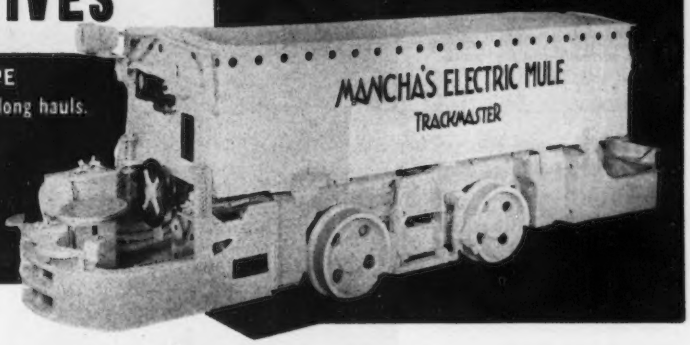
4 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

MANCHA . . .
STORAGE BATTERY LOCOMOTIVES

. . . for modern, safe haulage in mines

MANCHA'S STANDARD AN TYPE LOCOMOTIVE for heavy loads and long hauls.



Bet your life Mancha's Electric Mules promote safety. You've got to ball the jack for a muck bonus these days and chute pullers can't worry about trolley wire when they have to bar down a hangup or blast a blocked chute.

Mancha's Electric Mule lives up to its name. It's a tireless worker. Strong enough to pull heavy loads and low enough for restricted areas, it will operate in or out of the mine—wherever there is track. Feed it a fresh battery from Mancha's transfer rack and it's ready for another full shift. Durability, economy, reliability and safety are inherent qualities of this versatile locomotive.

Advantages of Mancha's Battery Transfer Rack:

1. Battery sets firmly on the chassis until safely supported by the transfer rack rails.
2. No chance for injury to equipment or personnel because of lifting rig failure.
3. Proper alignment between chassis and transfer rack is assured—no jockeying for exact position required.
4. Manual labor is eliminated.

That transfer rack makes battery changing a one man job, even on this 6 tonner.

Mail the coupon for illustrated bulletin showing perfomance charts and complete specifications.

Mancha Storage Battery Locomotive, U.S.A.
Division GOODMAN Manufacturing Company
4850 South Halsted Street, Chicago 9, Illinois
E&MJ 6/51

NAME _____

FIRM _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

Fast • Positive • Safe • Easy

MANCHA STORAGE BATTERY LOCOMOTIVE
Division GOODMAN *Manufacturing Company*
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

They did...

HOW these results were produced is the core of this story. CW&F came to us with a question on *method*—not for quotations on a device.

what...

The answer was worked out with Nordberg and the CW&F engineers by our staff. They attacked the problem as a whole . . . and put together an *integrated* electrical and mechanical system of many devices.

you can do...

This method works for every mining process. In any electrical project, the devices themselves are secondary . . . it's how they're put together that counts.

to produce more

Developing integrated electrical systems that make mining more productive has been one of our major activities for 50 years. Your Westinghouse office is a good place to go when you have a job for electricity.

The Rototrol Regulator used on modern hoists gives smoother, faster and more trouble-free operation than previous control systems.

The story behind the *World's Record-holding Hoist*

Twenty-seven years ago the Chicago, Wilmington & Franklin Coal Company had a certain problem. How they solved it has a bearing on a number of problems you probably have today. CW&F president George B. Harrington tells the story:

"Astonishingly trouble-free operation"

"In 1923 my company decided to open one big new mine, instead of what would have become two good-sized operations. This decision raised a problem however—whether one hoist could lift more than 12,000 tons per shift the necessary 600 feet. After many slide-rule hours and with prayerful acquiescence on our part, we installed a combination of Westinghouse equipment and Nordberg hoist—new and exceptional in design. It has given astonishingly trouble-free operation ever since."

Never a major repair, none contemplated

In 1928 this hoist made the world's coal hoisting record—15,175 tons in one 8-hour shift. Yet the hoist has never required a major repair—and none is contemplated now. The motors and generators have their original windings, bearings and commutators. At no time in 27 years has a failure of this equipment caused lost production.

New Westinghouse equipment is even better

Westinghouse keeps close to mining problems and new hoist drives are even better than this record holder. Some new ones are completely automatic; don't need an operator at all. Rototrol® control is now used. It needs less maintenance and results in smoother operation.

Call Westinghouse early on every job

These results are typical of the performance Westinghouse builds into *all* electrical equipment for mining. When you're planning *any* new project, call in Westinghouse early. J-94898

YOU CAN BE SURE... IF IT'S

Westinghouse

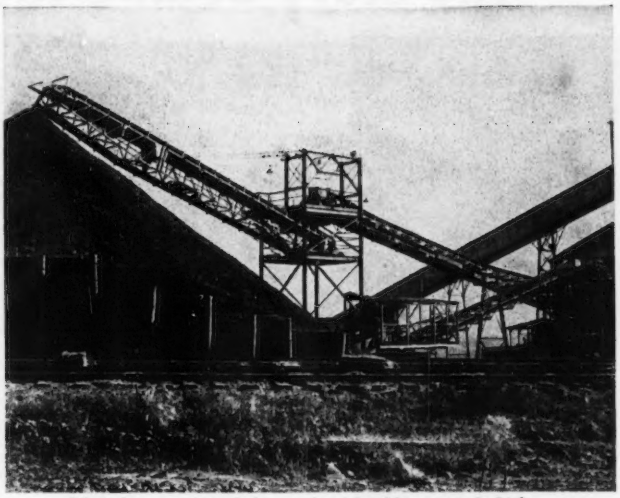
EQUIPMENT FOR MINING

LINK-BELT engineering experience...

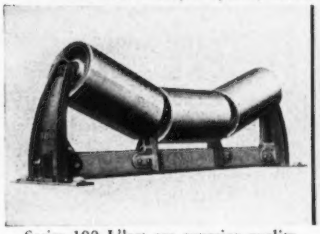
Plus

LINK-BELT quality components...

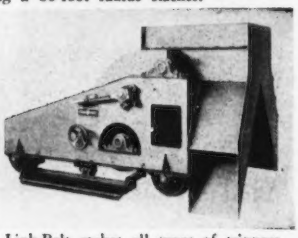
...add up to your best buy in BELT CONVEYORS



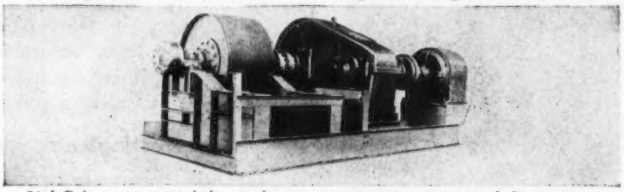
Washed iron ore is stocked out and reclaimed by means of a Link-Belt belt conveyor system, including a 60-foot radius stacker.



Series 100 Idlers are superior quality, with high-grade roller bearings and effective grease-in-dirt-out seal.



Link-Belt makes all types of trippers for discharging materials and distributing them along the conveyor belt.



Link-Belt power transmission equipment meets every conveyor need. Shown here: Link-Belt 300 H.P. fluid coupling drive and D-250 herringbone gear reducer.

YES, you get *both*—practical engineering and quality components—when you call on Link-Belt for belt conveyors! Thousands agree Link-Belt makes the finest belt conveyors on the market today.

Engineering experience? Our conveyor specialists draw on an accumulation of years of materials handling and power transmission experience. They will help you and your consultants get top performance from a modern conveying system.

Quality components? We design every item on a belt conveyor system and build it to the highest standards. We make all types and sizes of idlers, take-ups, pulleys, trippers, bearings, drives and supports. You get the *right* equipment for your exact requirements when you rely on Link-Belt.

See for yourself! Let us show you some of the modern conveying systems we have installed. See the results of practical Link-Belt engineering experience—simplicity of design, the finest components, and most important, *top performance.*

Remember, there's a Link-Belt conveying specialist in the branch office near you. Call him for complete engineering information.

LINK-BELT

BELT CONVEYOR EQUIPMENT 12,381-F

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in principal cities.

for BETTER, SAFER LIGHTING use . . .

JOY String-a-lite®

DURABLE • TROUBLEFREE • FOOLPROOF

Joy String-a-lite lines are of one-piece molded Neoprene construction—watertight, shatterproof, and age-resistant.

Oils, acids, alkalies or moisture have little effect on their life span or conducting efficiency.

Combinations can be easily installed, moved or varied, by untrained personnel, to fit the requirements of any mine lighting job.

FURNISHED IN VARIOUS LENGTHS WITH OUTLETS AT REGULAR INTERVALS, AS SPECIFIED

THREE LIGHT STYLES

EHS LAMP OUTLET

Snug fitting Neoprene lip at bulb neck seals out water, dirt and oil.

FSC SIDE OUTLET

Accommodates ERS "Plug-in" Socket or Hand Extension Lamps.

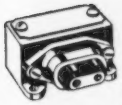
ERS PLUG-IN SOCKET

Converts FSC Side Outlet to Weather-Sealed light socket.

VEIS VAPOR-PROOF LIGHT

Has glass globe with sturdy metal guard, for protecting light bulb. 100 watt size.

SAFE POWER CONNECTIONS



241FR FEMALE RECEPTACLE

A power outlet, consisting of Neoprene insert in sturdy metal housing. No. LFR—same as above except with insert for engaging hand extension lights below.

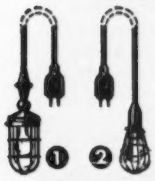
AHBED EXTENSION

100′ of Neoprene covered cord with 241M Male and 241F Female Connectors, factory molded on ends.

241F POWER LEAD

Female Connector on cable length specified by customer. Other end open for wiring into power source.

HAND EXTENSION LIGHTS

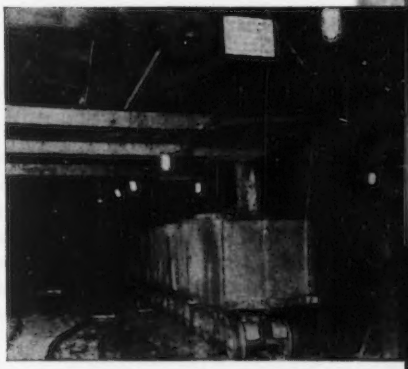


Choice of Weather-proof or Vapor-proof lamp styles molded to Neoprene covered cord with LMC Male end Connector. Accommodates up to 100-watt standard Edison based bulbs.

Cord Length	1—Vapor-proof	2—Weather-proof
25′	V5A	W5A
50′	V6A	W6A

JOY String-a-Lite installations at Chief Consolidated Mining Company, Eureka, Utah.

ABOVE—Photo illustrates convenience and safety of JOY Vapor-proof Lights in exceptionally wet working areas.



ABOVE—JOY VEIS Vaporproof String-a-lite illuminating an important haulage-way.

Write for your free copy of Bulletin SL-202 or *Consult a Joy Engineer*

W&D MR3868

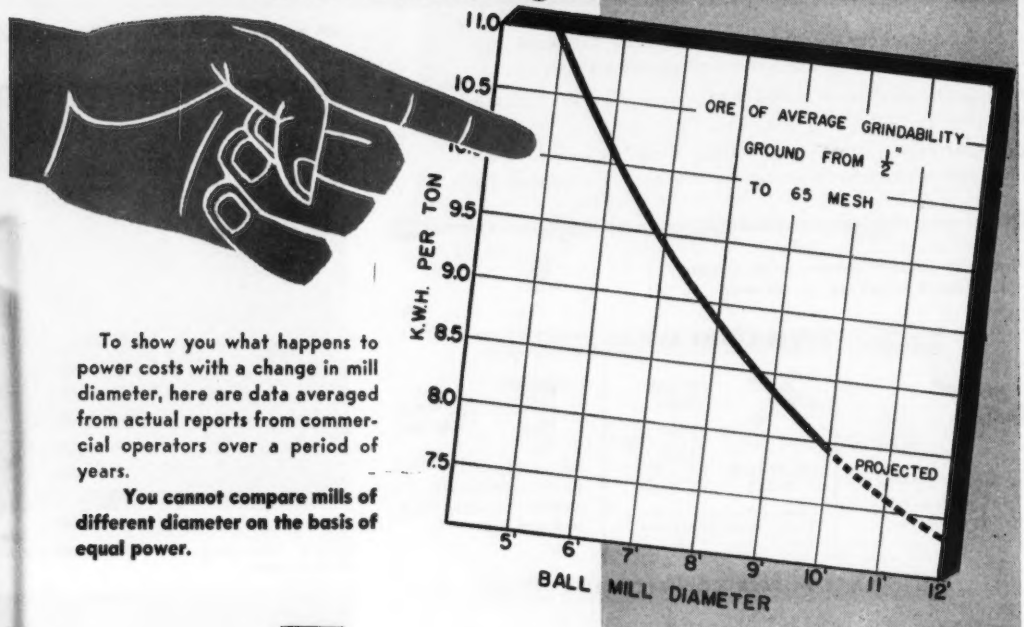
JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

HERE'S PROOF...

Power Consumption Varies With Grinding Mill Diameter!



To show you what happens to power costs with a change in mill diameter, here are data averaged from actual reports from commercial operators over a period of years.

You cannot compare mills of different diameter on the basis of equal power.

Size for size, MARCY low pulp line ball and rod mills have been proved to have greater capacity than grinding mills of any other type, with corresponding savings in power per ton of finished product and generally better metallurgical results. Ask our engineers to analyze your grinding problems without cost or obligation to you.

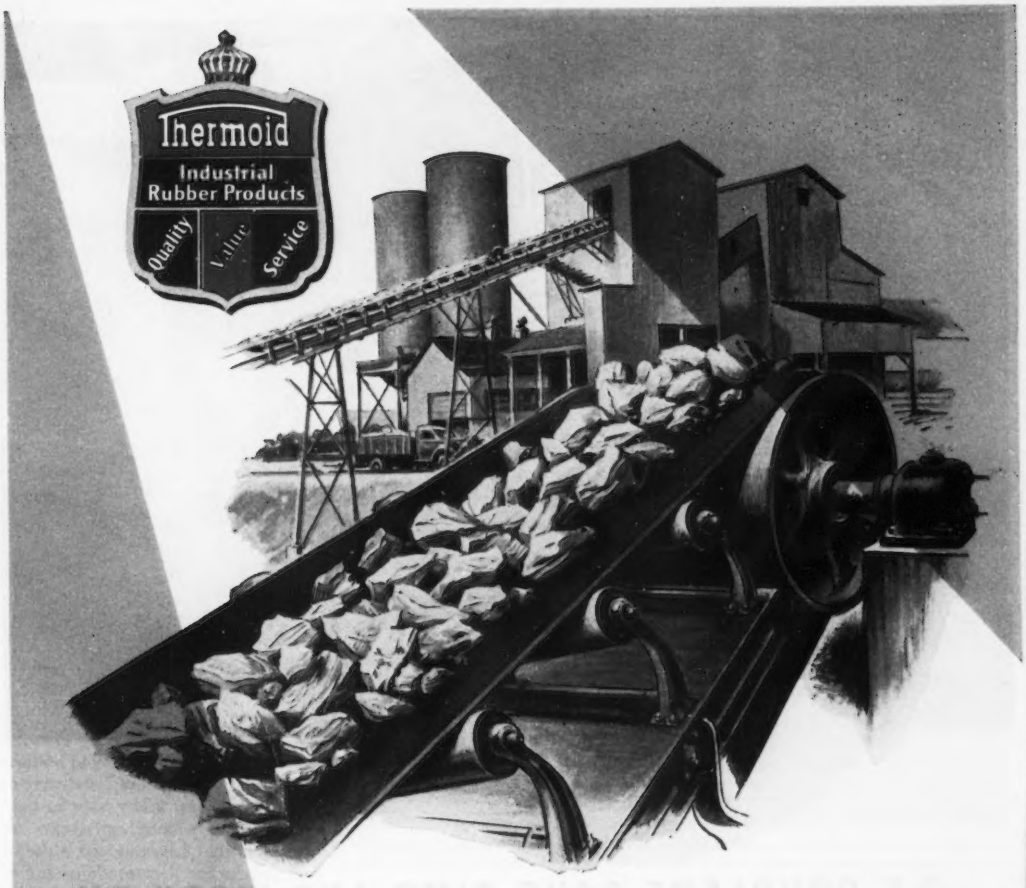
OTHER PRODUCTS

Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

THE Mine & Smelter SUPPLY COMPANY

Main Office: DENVER, COLO., U.S.A.; El Paso; Salt Lake City; 1775 Broadway, New York, N. Y.

Representatives: Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P. I.; The Ore & Chemical Co., 80 Broad St., New York 4, N. Y., for Continental Europe.



"Whatever Your Conveyor Belting Problem . . . *Thermoid Has The Answer*"

Whatever the job—whatever the nature of the materials to be handled—heavy or light, soft or abrasive, hot or cold, wet or dry, uniform or non-uniform in size—there is a Thermoid belt built to do the job at the lowest cost per ton of material handled.

Thermoid belts are made with an extra margin of endurance. You will find they stay on the job long after ordinary belts fail. With Thermoid, you will have fewer delays due to belt breakage or premature wear. Your Thermoid distributor will be glad to help you with your requirements.

Here's The Book That Will Answer Many Of Your Questions

Drop us a line for your free copy of Book No. 3679. It is a handy reference guide, concise and complete. 16 pages of valuable charts, tables and graphs tell how to select the right conveyor or elevator belt for the materials to be handled . . . how to determine capacities, speeds, weights and number of plies.

Conveyor & Elevator Belting • Transmission Belting
F.H.P. & Multiple V-Belts • Wrapped & Molded Hose

Thermoid

Rubber Sheet Packings • Molded Products
Industrial Brake Linings and Friction Materials

Thermoid Company • Offices & Factories: Trenton, N. J., Nephi, Utah

When the heads come together, the spring-loaded cam rises (dotted lines) and then falls to lock the two heads securely, rigidly

O-B COUPLERS SAVE TIME AND WORK BY

Joining Securely on Impact

The illustration of two coupler heads coming together brings out an important point--they are joining without guidance or assistance of any sort. Mine cars equipped with O-B Automatic Couplers join securely on impact and *stay* coupled. Contrast this with old-fashioned hitching methods which require a man to guide the heads and make the connection between them.

Think of what this means in terms of costs and safety. First, as we've pointed out, less manpower is needed to make up trips. Second, movement of trips is speeded because less time is needed to make them up. Third, a safety hazard is removed when it is no longer necessary for men to enter the "between cars" danger zone.

O-B Automatic Couplers enter the picture whenever there's a demand for quicker, cheaper movement from the face to the tipple. Ask your O-B representative, or write to Ohio Brass Company for more information on automatic coupling for your haulage system.

Ohio Brass

MANSFIELD OHIO, U.S.A.

CANADIAN OHIO BRASS CO., LTD., NIAGARA FALLS, ONT.

4102 AM

Battle with stubborn rock ends with completion of Boston's 5¼-mile tunnel

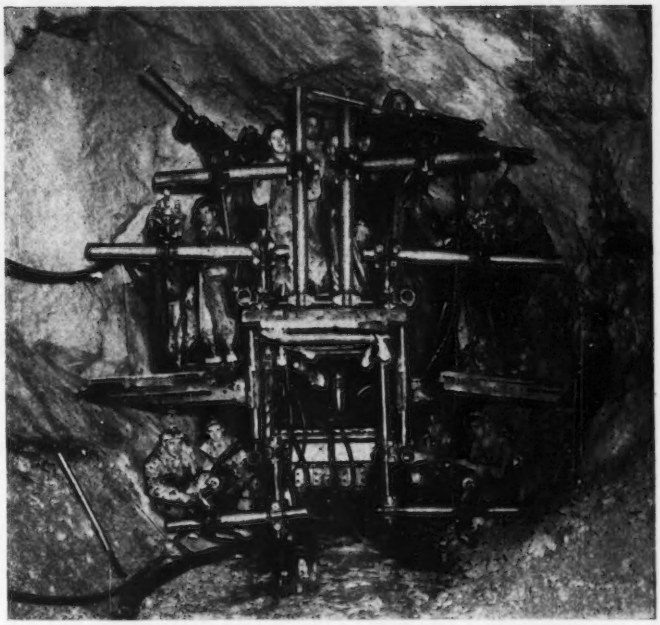
"Toughest rock I ever saw," says J. R. Glaeser, referring to the 27,900-ft Boston City Tunnel completed in November, 1950, by Perini Maney Walsh & Rugo Construction Companies for the Metropolitan District Water Supply Commission of Boston. Glaeser, job manager for the $9,530,000 contract, is a veteran tunnel-driver who has tackled a lot of hard rock in his time.

City Tunnel, part of Boston's Hultman Aqueduct, is the first link of a pressure tunnel under Metropolitan Boston. For the most part a bore of 12-ft finished diameter, it extends from the end of the pressure aqueduct at Riverside, Weston, under Newton, to the Chestnut Hill Pumping Station in Boston.

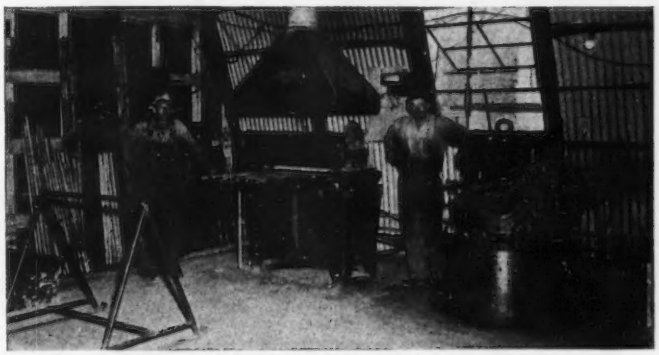
Driven from four headings, the job required the excavation of 190,000 cu yd—most of it a very hard conglomerate for 23,900 ft of the job. Long stretches of melaphyre, basalt, and argillite proved to be tough and hard to penetrate. Drilling and blasting this kind of rock was a real challenge to the contractors because ordinary detachable bits averaged only 6 inches in this stubborn rock before they became dull. And when serious delay appeared certain, carbide insert bits came to the rescue, reducing costs and improving drilling speed as much as 50 per cent.

Drill jumbos, each mounting six 4-in. drifter drills, put in 50 to 60 holes, 10 ft deep, in three or four rounds every 24 hours. Daily progress averaged 30 ft at each heading.

The contractors drilled 1,495,000 lineal feet of blast holes, using Bethlehem Hollow Drill Steel every foot of the way. "Your drill steel did an excellent job," says Glaeser, "far better than might be expected under very difficult drilling conditions."



Drill jumbos mount six 4-in. drifter drills. Using carbide insert bits and Bethlehem Hollow Drill Steel, the contractors averaged 30 ft of advance daily through very hard types of conglomerate rock formations.



This well-equipped blacksmith shop near Shaft No. 6 kept the drilling crews supplied with rods of Bethlehem Hollow Drill Steel, a reliable steel that hard rock men can rely on when the going is tough.

Contractors: Perini Maney Walsh & Rugo Construction Companies—Jesse R. Glaeser, job manager; Charles Kelley, general superintendent; P. M. Putnam, chief engineer.

Metropolitan District Water Supply Commission of Boston, Mass.—Fred Gow, construction engineer; John Verdic, resident engineer; Karl R. Kennison, chief engineer.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

★ BETHLEHEM STEEL ★

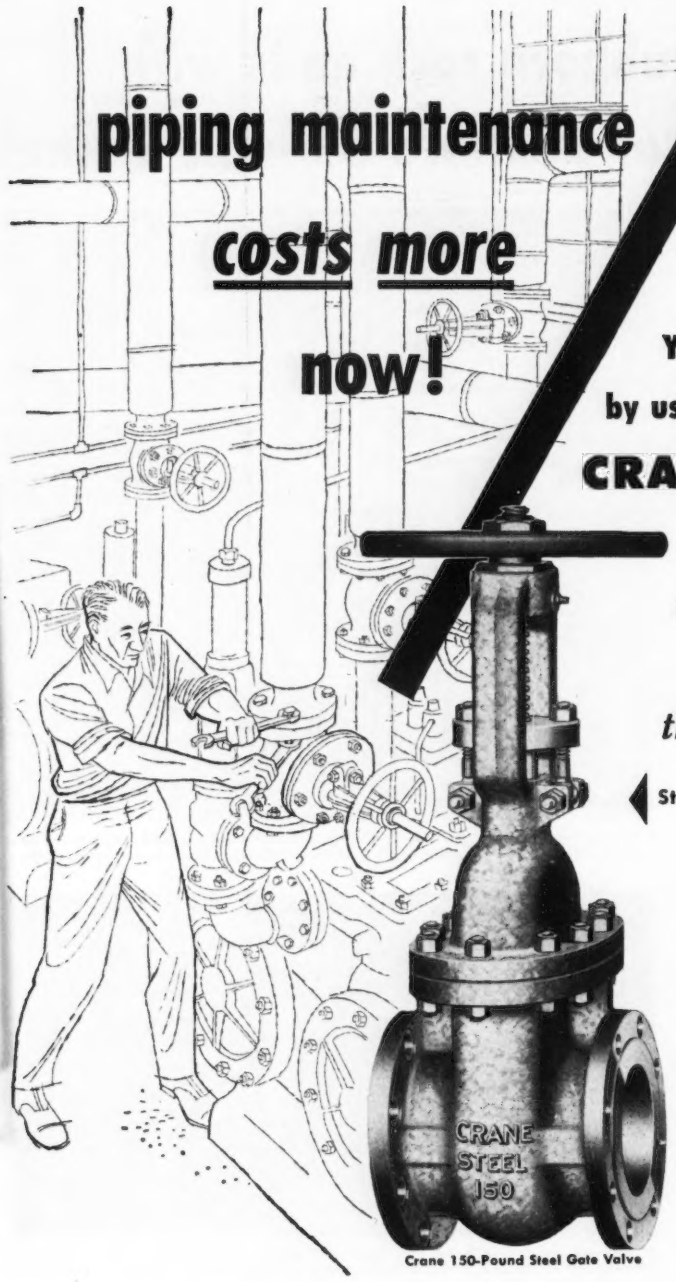
BETHLEHEM HOLLOW DRILL STEEL

piping maintenance *costs more* now!

You spend less for it by using Dependable Quality

CRANE VALVES

. . . That's why more Crane Valves are used than any other make



Crane 150-Pound Steel Gate Valve

Steel valves that stay on the job

You can practically forget valve maintenance worries with Crane Cast Steel Wedge Gates. They're unusually rugged . . . amply reinforced at all stress points. Disc is precision-guided to reduce seating surface wear. Straight-through ports give smooth flow, with minimum turbulence and erosion.

Stuffing box depth and design assure tight stem seal...long packing life. Valves available in trim materials for steam, water, gas, oil, and oil vapor services.

Ask your Crane Representative about the better quality and greater dependability of Crane valves—your assurance of on-the-job performance that spells lower final cost.

CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Here's a Wire Rope That LASTS

J&L STEEL

Operators Get Longer Service Life with . . .

J&L CenterFit Wire Rope

If you're responsible for the wire rope on clamshells, shovels or any other earthmoving equipment that operates on small diameter sheaves and drums, J&L CenterFit Wire Rope can help you save money.

CenterFit, produced exclusively by Jones & Laughlin Steel Corporation, has a unique design engineered to give you more steel and fewer voids than conventional wire rope. All strands run in the same direction with outside strands fitting snugly into the valleys between inside strands. The result—greater strength . . . easier handling . . . which means longer service life.

In addition J&L CenterFit is lubricated with BRONZ-LUBE, the exclusive J&L lubricant with high film strength that prevents squeezing out between the strands. BRONZ-LUBE contains fine flakes of soft bearing metal that provide a smooth wear-resistant surface for every wire—forms a close adherent coating that doesn't drip off unless subjected to extremely high temperatures.

Users' records prove that J&L CenterFit lubricated with BRONZ-LUBE reduces operating costs, diminishes downtime and increases profits when used in the applications for which it was designed.

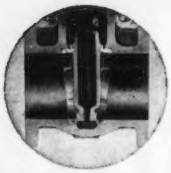
AND HERE'S HOW YOU CAN FIND OUT MORE ABOUT CENTERFIT WIRE ROPE!

Just write to Jones & Laughlin Steel Corporation, 412 Jones & Laughlin Building, Pittsburgh 30, Pa., and ask for a free copy of our booklet, "CenterFit." It gives you detailed information on the construction and applications of this exclusive J&L wire rope and tells how others are saving money through its use.

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY (*hi-tensile steels*).

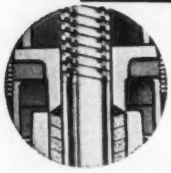
PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURAL SHAPES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS



Straight-Flow Port Design reduces fluid turbulence to a practical minimum.

Seat Rings of end-seated type are screwed into the body.

Sure-Grip Malleable Handwheel for non-skid gripping even with heavy gloves.



Brass Liner on Glands assures greater resistance to corrosion and scoring.

WALWORTH

iron body gate valves

with screwed or flanged ends

... 8 Outstanding Features

For complete information on these new Walworth Iron Body Valves, see your local Walworth distributor, or write for bulletin 106.

WALWORTH

valves and fittings

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

T-head Disc-to-Stem connection on OS&Y types provides stronger connection, prevents loosening of disc by corrosion.

Bronze Back-Seat Bushings in bonnets of OS&Y valves.

Solid Web Type Disc in OS&Y valves for greater strength and longer service.

Hinged Gland Eye-Bolts on OS&Y valves permit faster, easier repacking under full pressure.

You SEE the saving!

Above: EASTON BD hydraulic drop door truck bodies for rugged, versatile duty on earth, rock and ore moving jobs.

•

Below: EASTON TP pan type side-dump trailers for big payloads at low cost in shovel-to-crusher hauling.

•

Investigate these and other EASTON side-dumps. Capacities are limited only by the truck chassis of your choice.

Watch that smooth side-dump action!

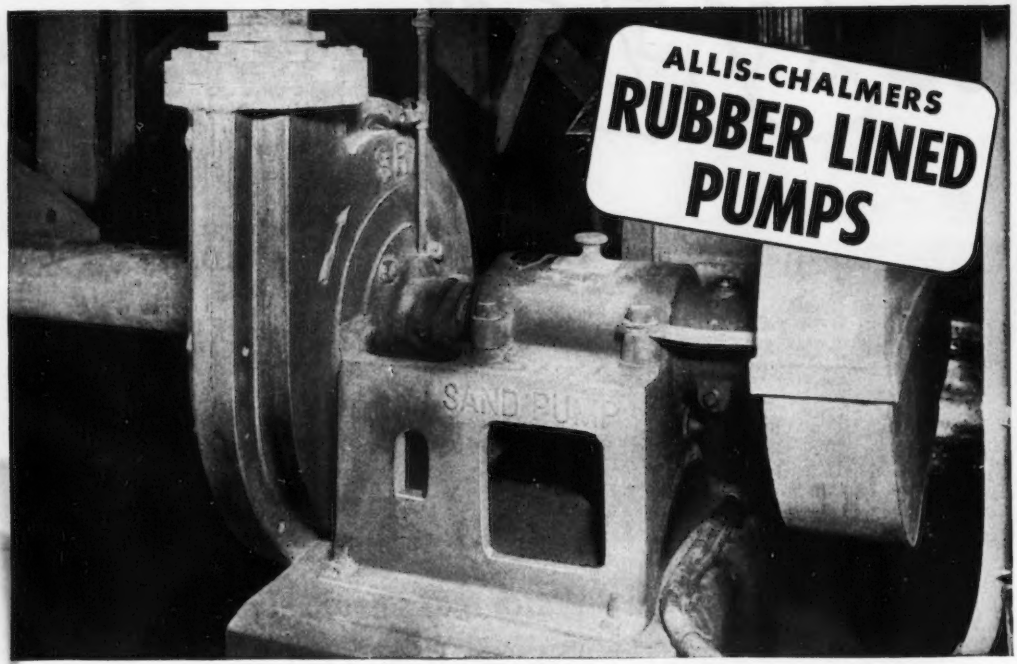
You *roll up, dump* and *roll on!* Side-dumping cuts out needless backing and turning. You can see the saving in time, money, effort!

B-1046

Get the facts straight from headquarters — from EASTON side-dump engineers!

EASTON
Side-Dumps

Easton Car & Construction Company, Easton, Pa. • Headquarters for Side-Dump Cars, Truck Bodies and Trailers



Gives You 4 Big Economies In Handling Fine Mesh Materials

1. **Long Life** — Rubber compounds especially made for each application provide from 10 to 50 times the wear resistance of the hardest metals on such jobs as pumping tailings, classifier overflow, grinding mill discharge and other operations involving hard, abrasive materials of ⅛" to 325 mesh size.
2. **Easy Servicing** — The rubber casing liner is completely separate from the casing. It may be removed and replaced without moving the pump itself. The impeller is screwed onto the shaft and also may be removed easily. Thus, a complete supply of spare parts may be kept on hand at moderate cost. Neither standby pumps nor long shutdowns for pump rehabilitation are required.
3. **Flexibility In Operation** — The Allis-Chalmers Rubber Lined Pump is usually driven by a *Texrope* V-belt drive. Its head and capacity may be varied considerably by simply changing the speed of the drive. Where changes are frequent, the *Vari-Pitch* Automatic sheave provides instant speed control at very moderate cost.
4. **Application Engineering** — Each job is individually engineered by a competent Allis-Chalmers application engineer who is familiar with solids pumping problems. You can be sure of exactly the right pump and exactly the right materials for lowest cost per ton pumped.

Get full details on what the Allis-Chalmers Rubber Lined Pump can do for you. Call your A-C District Office or write Allis-Chalmers, Milwaukee 1, Wisconsin, and ask for Bulletin 08B7311. A-3347

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

For worms and gears—in standard sets or to special requirements—or as worm-gear speed reducers, including the economical fan-cooled Speedaire unit—you can always depend on Cleveland.

High quality worms and gears to meet your needs

● You pay no more for Cleveland worms and gears—and yet, built into them are extra years of service and satisfaction.

Uniform, high quality has been an outstanding characteristic of Clevelands through 38 years—a generation devoted to the manufacture of fine worms and gears exclusively. Specifically, there are four ingredients of Cleveland quality:

1. Correctness of design—design proved best by years of performance.
2. The finest of materials, selected after years of experience and research.
3. Modern machine tool equipment, in a modern plant kept up-to-date by a policy of continuous replacement.
4. Machinists and other production workers who are craftsmen, trained in precision work.

So whatever your need, consult Cleveland. Sales representatives in all major industrial centers are at your service, to help you select correct types and sizes and discuss any phase of your power transmission problems.

Write for the latest Cleveland catalog, indicating your requirements. The Cleveland Worm & Gear Company, 3281 East 80th Street, Cleveland 4, Ohio.

Affiliate: The Farval Corporation, Centralized Systems of Lubrication. In Canada: Peacock Brothers Limited.

here's the STOPER
CP-34

FOR MAXIMUM FOOTAGE FROM TUNGSTEN-CARBIDE BITS

here's the DRIFTER
CP-50N

To insure long service from tungsten-carbide bits, rock drills should combine strong rotation and fast hitting action with just the right foot-pound blow for maximum penetration.

Chicago Pneumatic's medium-weight, fast-hitting CP-34 Stoper and CP-50N Drifter are ideal for tungsten-carbide bits. Rotation, drilling speed and foot-pound blow are nicely balanced, eliminating excessive machine vibration and assuring maximum bit life.

Write for complete information.

CHICAGO PNEUMATIC TOOL COMPANY
General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

triple play for profit

with P&H ELECTRIC SHOVELS

All three of these P&H Electric Shovels are at work for J. Robert Bazely at Pottsville, Pa. There are three sizes at work here — 4, 5 and 6 cu. yds., all delivering steadily at rock bottom costs.

P&H leads the field in Electric Shovel Developments.

It's the same pattern wherever these new P&H Electric Shovels go to work: The first machine sells the second — the third — and more.

The reasons are plain and simple — *better performance — bigger production — lower tonnage cost.*

Reasons behind the reasons are such advantages as P&H Magnetorque* which powers hoisting motions electro-magnetically — smoother, faster, more dependably . . . rugged all-welded construction with more strength to withstand shock loads . . . independent propel for quicker move-ups . . . stepless control which eliminates all contactor troubles . . . filtered air cab ventilation for less electrical down time.

The cold, hard facts that count are: *performance, production, low tonnage cost.* Figure your costs with P&H Electric Shovels and you'll find a convincing difference. It explains why every third P&H Electric Shovel sold is a repeat order.

*T. M. of Harnischfeger Corporation for electro-magnetic type clutch.

P&H ELECTRIC SHOVELS
4454 West National Avenue
Milwaukee 14, Wisconsin
HARNISCHFEGER

Every third P&H Electric Shovel sold is a repeat order

EXCAVATORS • OVERHEAD CRANES • HOISTS • ARC WELDERS AND ELECTRODES • SOIL STABILIZERS • CRAWLER AND TRUCK CRANES • DIESEL ENGINES • PRE-ASSEMBLED H

Mining Tires
exactly fitted for their work

When we say "exactly fitted" we mean a mining tire built for the toughest conditions OFF THE ROAD, while giving a smooth long-wearing roll on the highway.

This *off-the-road* and *on-the-road* problem has now been solved. Both mining requirements have been fully met and mastered.

These are the facts about the U. S. ROYAL FLEETMASTER which can contribute to a radical reduction in your tire costs.

- ★ ***70% Deeper Traction Tread!*** (For complete holding penetration OFF THE ROAD! With long-wearing smoothness on the *highway*)
- ★ ***Tougher, Stronger Carcass!*** (Permitting even greater additional safe mileage with more recaps)
- ★ ***Special Tread Compounds!*** (Utmost in cut and chip resistance)
- ★ ***Round-Moulded Carcass!*** (Natural inflated shape reduces distortion strain)
- ★ ***Thicker Under-Tread!*** (Your bed-rock for super-traction and mileage)

These U. S. Royal Fleetmaster facts add up to *reduced tire costs — increased efficiency — lower maintenance!*

A phone call does it! **To your nearest U. S. Royal Distributor! He's listed in the Classified Telephone Book!**

UNITED STATES RUBBER COMPANY

how to win at "TWO-FINGERED" tug-of-war!

With just two fingers, your operator easily controls the single throttle lever on the Gardner-Denver Airslusher. Yet this load-lugging double-drum slusher hoist hauls a full pay load every trip — hurries the scraper back to the muck pile — pronto!

It's powered by the famous Gardner-Denver 5-Cylinder Radial Air Motor that tugs stubbornly at any speed — develops top speed and power in either direction.

Gardner-Denver Airslushers don't waste air idling between trips. Three sizes, for 1100, 2000 or 2500 pounds rope pull.

SINCE 1859

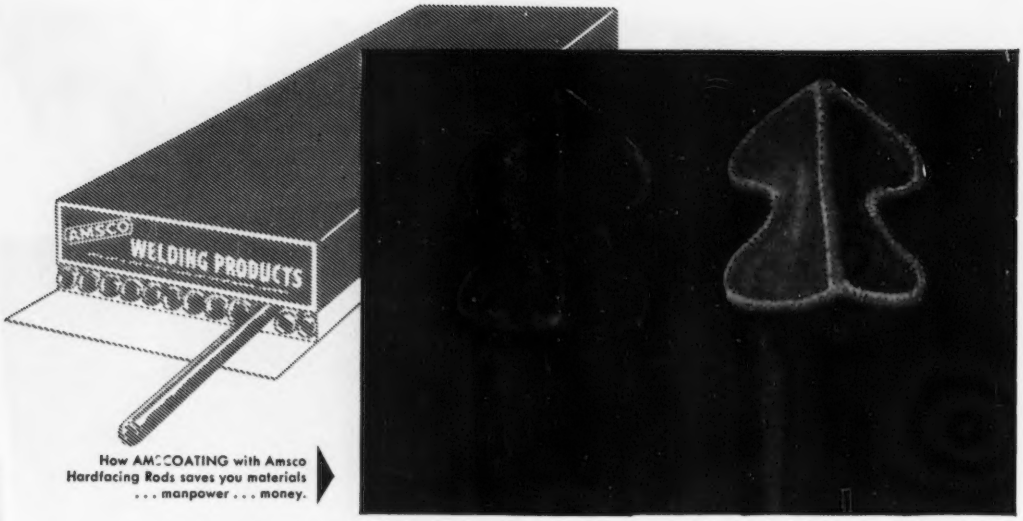
GARDNER-DENVER

Write for bulletins giving complete information.
Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., Toronto, Ontario

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS

Completely protected against dirt and water, handy Gardner-Denver Air Hoists are made in several sizes, and for various rope capacities.

Designed for *safe* one-man operation, the Gardner-Denver HMS Shaft Mucker is widely used on shaft mucking rigs. Positive safety lock.



How AMSCOATING with Amsco Hardfacing Rods saves you materials . . . manpower . . . money.

Why will ONE of these bits LAST TWICE AS LONG?

AMSCOATING...stands for control of wear by Hardfacing...

Hardfacing rods—and recommendations for their use—are as sound as the manufacturer who makes them. AMSCO has been fighting wear for a half-century—first with Manganese Steel, and later with AMSCO Hardfacing Products.

If you have a problem of wear caused by impact, abrasion, heat or corrosion . . .

Find out how AMSCOATING can save you materials . . . manpower . . . money!

These bits are used by a Southern quarry for drilling blast holes. A combination of limestone and flint causes extreme abrasion—and a real problem of wear. In an attempt to cut replacement costs, labor and down-time, several makes of hardfacing rods were tried, but without much success.

Six years ago these bits were AMSCOATED with an Amsco® rod specially developed for combatting abrasion and impact.

Result? AMSCOATING did a job that had never been done before. The drill bits held their edges longer . . . averaged 60 hours of drilling—between regrinds—instead of 30. Maintenance costs and bit changes were cut in half!

AMSCOATING saves you money in terms of lower maintenance costs, less down-time . . . more production. *The actual on-the-job example cited above is one of the many applications that prove it!* Write today for illustrated catalog describing dollar-saving AMSCO rods . . . and the name of your nearest AMSCO distributor.

AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

Brake Shoe | **AMERICAN MANGANESE STEEL DIVISION**
376 EAST 14th STREET • CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

B.F.Goodrich

How mine operator gets extra traction, more recaps per tire

THE PENOWA COAL COMPANY, Burgettstown, Pa., conducts both deep mine and extra mine stripping operations on their 5,500 acre holdings in northern West Virginia and southern Pennsylvania. The company operates some 75 vehicles ranging from 18-ton capacity dump trucks to a grader, deep mine shuttle cars and even jeeps.

Most of the trucks, of course, are big dump trucks and haul coal over unpaved roads of red clay, slag and stony shale. Tire traction is a major problem. If one truck bogs down, all operations stop until that truck moves.

"We switched to B. F. Goodrich Universal tires," says A. M. Gardner, purchasing agent, "after it was pointed out that trucks equipped with these tires could get through when others bogged down. At the present time, 95% of our equipment is on BFG tires." And Eldo Bruner, shop foreman, added, "The traction is far superior to that obtained with any other brand. After switching to nylon casings, we found that we were able to get many more factory recaps per tire and have less tire trouble."

Here's real tire service for you. Trucks roll 20 hours a day, six days a week. And they're getting as many as 4 factory recaps per tire! In the deep mine they're getting up to 2 years of service from B. F. Goodrich tires.

There's a special B. F. Goodrich tire for every off-the-road need . . . a special tread and special construction. And, of course, BFG's have the added protection of the patented *nylon shock shield*. Layers of strong, elastic nylon are built in between the tread rubber and the cord body, shielding the cord body by absorbing and distributing shocks and strain.

For tires for any type of mine service you can depend on B. F. Goodrich for extra service. *The B. F. Goodrich Company, Akron, Ohio.*

RESEARCH KEEPS
B.F.Goodrich
FIRST IN RUBBER

NEW exploration and development programs call for maps—*fast!* And AERO mapping—with its speed, accuracy, and ability to work "round-the-clock"—is the answer.

That's why AERO maps for mining companies all over the world. AERO's staff of mapping experts (more than 200 men) deliver dependable topographic maps *months ahead of ground schedules.* AERO mapping is not slowed by rugged terrain . . . compilation is not limited to daylight hours in the field. AERO mapping can go forward night and day.

AERO has made more airborne magnetometer surveys than anyone else—nearly a half million miles for iron, nickel, chrome, asbestos, and oil. These aerial surveys have helped mining geologists uncover important new finds in the United States, Canada* and Africa.

Mining engineers find that AERO produces topographic maps of greater accuracy and with more detail than ground methods—good reasons why they rely on us to speed their work. When AERO does the job, your own staff is available for engineering designing and planning.

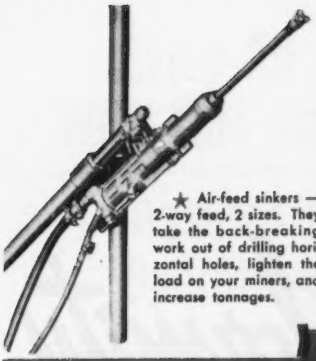
Put your mapping problems in AERO's hands. We can fulfill your requirements—*often at half the cost of ground methods.*

TOPOGRAPHIC MAPS • PLANIMETRIC MAPS

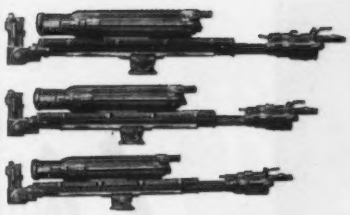
PRECISE AERIAL MOSAICS • AIRBORNE MAGNETOMETER SURVEYS

RELIEF MODELS • COLOR PHOTOGRAPHY

**In Canada our affiliate is CANADIAN AERO SERVICE, LTD., 348 Queen Street, Ottawa, Ontario.*



★ Air-feed sinkers — 2-way feed, 2 sizes. They take the back-breaking work out of drilling horizontal holes, lighten the load on your miners, and increase tonnages.

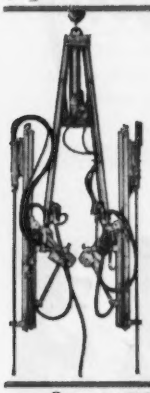


★ Power-feed and hand-cranked drifters. Dependable, powerful, and fast. Ideal for columns and jumbos alike.

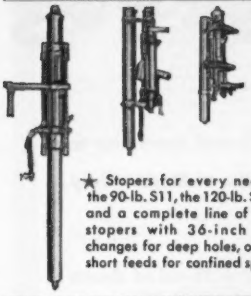
★ A complete line of sinkers from 18 to 80 lbs. including the popular 45-lb. H10, and 55-lb. H111.

It's Le Roi-CLEVELAND for *Rock Drills You Can Count On*

. . . . . fast-drilling, dependable favorites of mining men since 1906



★ The SDR 34 shaft sinker for faster shaft sinking. Fully closed it's 5'6" between drill centers; open 19'3". All adjustments quickly made with air motor.



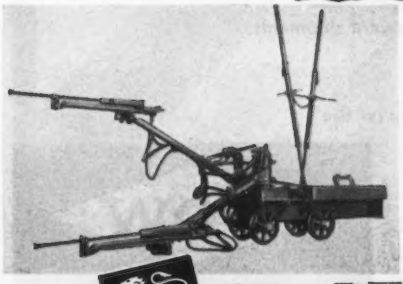
★ Stopers for every need — the 90-lb. S11, the 120-lb. SS-22, and a complete line of offset stopers with 36-inch steel changes for deep holes, or with short feeds for confined spaces.

Of course, you know that Le Roi-CLEVELAND builds the popular, easy-holding H10 and H111 sinkers... the fast-drilling PD24, 25, and 14 power feed drifters . . . the S11 and SS22 stopers with trip rotation for easier handling . . . and a mine jumbo that lets you drill out your rounds faster, with greater safety.

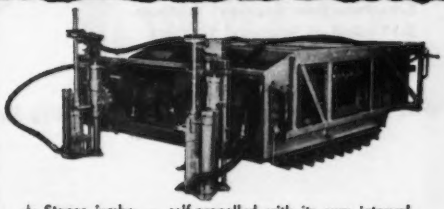
But did you know that Le Roi-CLEVELAND was responsible for some famous "firsts"? Here are a few of them—work-savers that help your miners increase their man-shift production: the air-feed sinker, the offset stoper, the shaft sinker, the stoper jumbo.

So if you have a job of drilling to do—do it with Le Roi-CLEVELAND machines. You can count on them. They're built for speed. And they're built to stay underground, too — where you can use this speed to do more work and cut your costs.

Detailed information about the complete Le Roi-CLEVELAND rock drill line is yours for the asking. Just write us.



★ The famous MDR Jumbo with air-motor poweredbooms for quicker set-ups, greater safety, faster rounds.



★ Stoper jumbo — self-propelled with its own integral dust-collection system for positive dust control, the latest thing for roof bolting.

LE ROI COMPANY RD-39

CLEVELAND ROCK DRILL DIVISION
12500 Berea Road, Cleveland 11, Ohio
Plants: Milwaukee, Cleveland and Greenwich, Ohio

Bear Brand Xanthates bring . . . . . Uniformity

BEAR BRAND XANTHATES
available

- Z-3—Potassium Ethyl Xanthate
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- Z-5—Potassium Amyl Xanthate*
- Z-6—Potassium Pentasol Amyl Xanthate*
- Z-8—Potassium Secondary Butyl Xanthate
- Z-9—Potassium Isopropyl Xanthate
- Z-11—Sodium Isopropyl Xanthate

*From Sharples Amyl Alcohols

The constant uniformity of Bear Brand Xanthates is one of the outstanding characteristics of these widely accepted flotation reagents.

Users know that any single drum or carload of drums can be depended upon to show the same quality as previous or subsequent shipments.

"Over Twenty-five Years Experience in Producing Xanthates for Metallurgical Use"

THE DOW CHEMICAL COMPANY
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DOW CHEMICALS

Every Air Hose With This Trademark

Assures Long Operating Life

Air hose economy is not measured in feet per dollar. The only true yardstick of air hose value is *service hours.*

Because every BWH hose has been developed, tested and field-proven to give the best possible combination of strength, safety, flexibility and damage resistance . . . *you get maximum service life.*

Whatever brand of hose you are now buying, you are paying for BWH benefits — so why not start getting them — *now?*

Today, contact your nearby BWH Distributor.

CONCORD AIR

An extra quality, exceptionally rugged hose for toughest use on air drill and pneumatic service in mines, quarries and construction jobs. Non-porous tube resists heat and oil. High tensile cotton yarn braid reinforce carcass. Tough grey cover resists cutting, gouging, abrasion. Made in ¼" 2-braid and ⅜" 2-braid sizes. 200 to 300 lbs. working pressure. Maximum length 50'.

BAY STATE AIR DRILL

For heavy construction work in mines, quarries, tunnels and wherever large size hose is required for long service. Smooth black tube resists heat and oil. Carcass of strong, rubber-impregnated multiple ply woven duck. Rugged, heavy-gauge red rubber cover resists severe weather extremes, cutting, abrasion. 9 sizes stocked from ½" to 4". Working pressures from 175 to 225 lbs. Maximum length 50'.

AUROCHS AIR

For portable air compressors, jackhammers, rugged industrial and construction work. Smooth, black, non-porous tube resists heat and oil. Carcass: multiple ply, rubber-impregnated, rugged woven fabric. Tough black cover resists weather and abrasion. Socked sizes: ½", ¾", 1". 200 lbs. working pressure. Maximum length 50'.

VIM AIR

For general industrial use, on compressors and pneumatic tools. Black tube resists oil and heat. Husky cotton yarn braids. Smooth, red cover resists weather, abrasion. 8 sizes stocked, ¼" 2-braid to 1" 3-braid. Working pressures 150 to 225 lbs. Maximum length 500'.

BULL DOG VARI-PURPOSE AIR

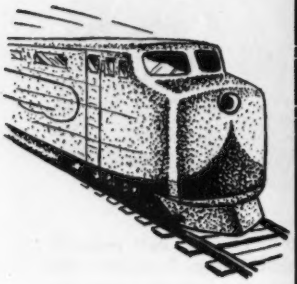
For a variety of jobs including handling of air, water, oil, gasoline, kerosene (not for paints, lacquers, lacquer-solvents). Black, synthetic tube resists oil and heat. Carcass is braided rayon cord, high strength, super flexible. Smooth, brown, tough synthetic cover resists oil, abrasion, sunlight. 11 sizes stocked from 3/16" one-braid to 1" 2-braid. Working pressures: 200 to 300 lbs. Maximum length approximately 500'.

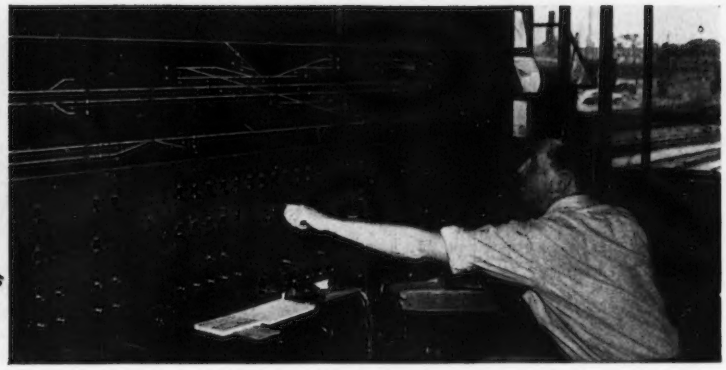
BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: CAMBRIDGE, MASS.

P. O. BOX 1071, BOSTON 3, MASS., U. S. A.





REACHING OUT 20 MILES TO LEAD A TRAIN

Railroad signal and communication engineers require dependability above all other things in the equipment which they buy. When it comes to signal cables, which are the vital connecting links between control machines and signals, they have a serious problem. If the cables are installed in the air they are subject to cinders, sparks, heat, sunlight, sleet and rain. If they are installed underground, the cables must be able to withstand long-time exposure to water, soil acids and alkalies, vibration from passing trains, and the cutting effect of sharp cinders. This is brutal punishment. So how to get trains through safely and on time — not once, but every day in the year?

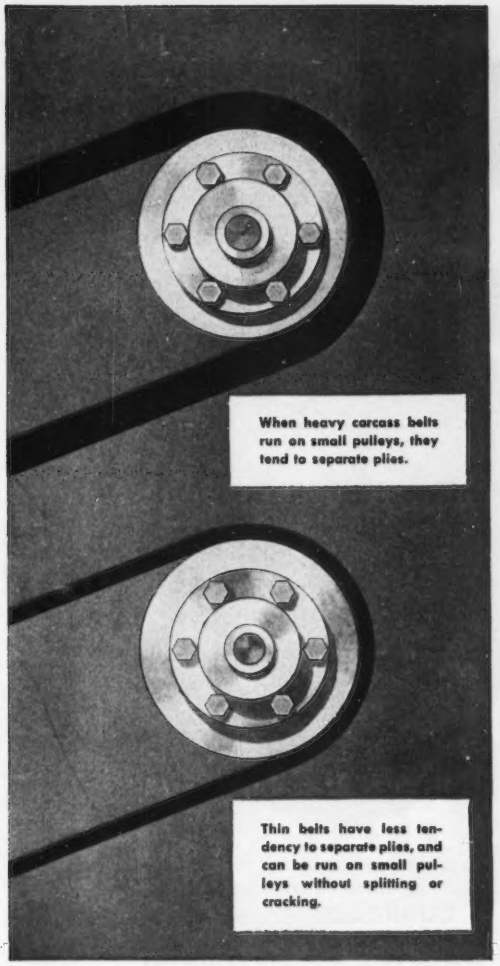
Fortunately, long before the railroads started to use CTC (Centralized Traffic Control) Simplex had developed an insulation that had excellent properties for signal and communication work and was dependably water resistant. That solved the moisture problem. The use of especially compounded neoprene as a jacketing material solved the problem of how to combat sparks, heat, sunlight, rain, etc. This is a typical example of how Simplex Research helps to provide just the right cable for the job.

Simplex Research gave you the first heavy duty, rubber-jacketed portable cord or cable; the first low water absorption insulation; the first rubber-jacketed underground cable. Besides these notable "Firsts" Simplex Research has provided a great many developments which have enriched the art of cable design.

SIMPLEX-ANHYDREX IS A PRODUCT OF SIMPLEX RESEARCH

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.


When heavy carcass belts run on small pulleys, they tend to separate plies.
Thin belts have less tendency to separate plies, and can be run on small pulleys without splitting or cracking.

MORE FLEXIBILITY. Belts built with "Cordura" have less tendency to crack and separate plies when run over small pulleys required in confined working space. And belts built with "Cordura" have less stretch, so less take-up room is needed. In addition, they trough well under any loading conditions.

OPERATING ECONOMIES YOU CAN GET FROM YOUR NEXT CONVEYOR BELT

Before you buy your next conveyor belt, be sure to consider the new belts built on Du Pont Cordura* High Tenacity Rayon. Belts sinewed with "Cordura" offer you many operating advantages . . . yet *cost no more.*

Just as sinews of "Cordura" make possible thinner yet stronger truck tires, they now give you a conveyor belt that is lighter and more efficient.

That's because "Cordura" is inherently stronger than natural fibers commonly used. And it is made in continuous filaments . . . with no short ends to pull apart under strain.

We'll be glad to send you the names of suppliers of the new belts built on "Cordura." We'll also give you full information about "Cordura" in the new booklet "Sinews for Industry." It describes the physical properties of "Cordura," how it has been used in many successful applications, and tells how "Cordura" improves the efficiency of conveyor systems. For your free copy, address Room 4529, Rayon Div., E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

*REG. U. S. PAT. OFF.

DU PONT "CORDURA" HIGH TENACITY RAYON

DU PONT

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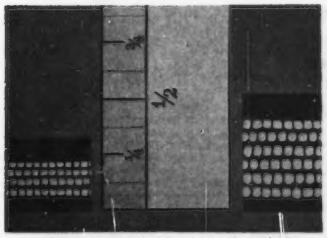
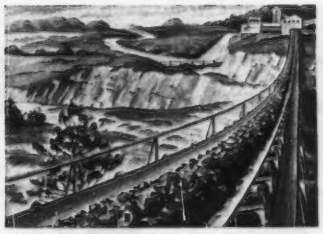
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

for RAYON . . . for NYLON . . . for fibers to come look to DU PONT



GREATER STRENGTH of belts built with "Cordura" is illustrated above. At left is cross-section of four-ply belt sinewed with "Cordura." It's stronger than conventional six-ply belt at right, yet only half as thick. This thin, light belt is particularly desirable where panel equipment is moved frequently.



SPAN LONGER LIFTS. The high tensile strength of "Cordura" rayon eliminates costly transfer points. For example, a belt reinforced with seven plies of "Cordura" can lift 1000 tons of overburden per hour up a 15° slope over 1000-foot centers. It has design tension of 900 pounds per inch of width.

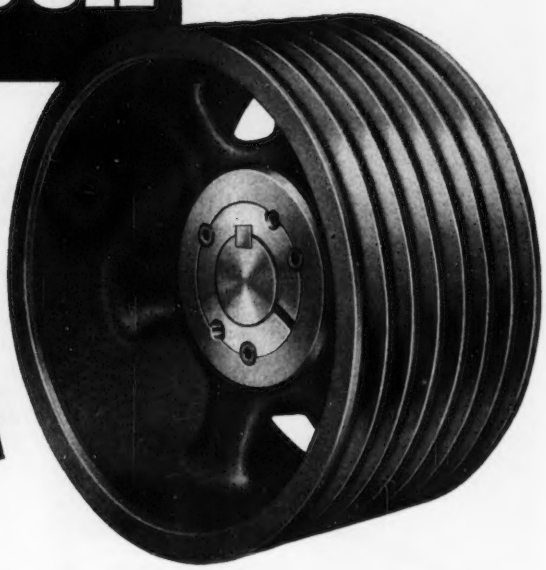
HEAVIER LOADING CAPACITY is possible on conveyor belts built with Du Pont "Cordura" High Tenacity Rayon. This yarn is inherently stronger than the natural fibers commonly used. It packs extra strength into conveyor belts and enables them to carry loads to the capacity of power equipment.

There's only one
TAPER-LOCK

Precision-Grooved

True Running

Easy on—Easy off



TAPER-LOCK bushing grips the shaft for the full length of the bushing — holds sheave with firmness of a shrunk-on fit. No wobble. Taper-Lock runs true!

No flange—no collar—no protruding parts. Flush machine-tool appearance.

Finest grade of close-grained semi-steel, cast in the Dodge foundry.

The grooves, machined on precision equipment, have identical pitch diameters. This insures equal belt tension. Every belt pulls its share of the load!

TAPER-LOCK sheaves are available from distributors' stocks in complete range of sizes in A, B, C and D grooves.

DODGE SEALED-LIFE BELTS have special protection for tension members, insuring longer belt life. Perfectly matched to TAPER-LOCK sheaves.

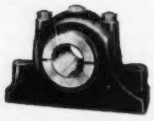
DODGE MANUFACTURING CORPORATION, 3100 Union Street, Mishawaka, Ind.

DODGE
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable assistance on new, cost-saving methods. Look for his name under "Power Transmission Equipment" in your classified phone book.

FIRST IN POWER TRANSMISSION MACHINERY!

V-BELTS AND TAPER-LOCK SHEAVES



DODGE-TIMKEN PILLOW BLOCKS

ROLLING GRIP AND DIAMOND D CLUTCHES

SOLID STEEL CONVEYOR PULLEYS

LOAD IT . . . MOVE IT . . . DUMP IT-

At LOWER COST with Firestone TIRES

When you're handling big loads, speeding them out over your haul roads to dump . . . when you're doing this day in and day out in all kinds of weather, you have to have tires that can "take it."

Firestone Tires can take it, because they're made to take it, made with strong, Gum-Dipped rayon cord bodies . . . made with four extra impact plies to protect the bodies . . . made with double-thick, snag-resistant sidewalls . . . made with extra heavy treads engineered to fit the job.

Give Firestone Tires a trial on your equipment. You'll find that all along the line, trip in and trip out, they speed your work, cut your downtime, and boost your profits.

WHEN YOU BUY NEW EQUIPMENT OR REPLACEMENT TIRES SPECIFY FIRESTONE OFF-THE-HIGHWAY TIRES

Enjoy the Voice of Firestone on radio or television every Monday evening over NBC

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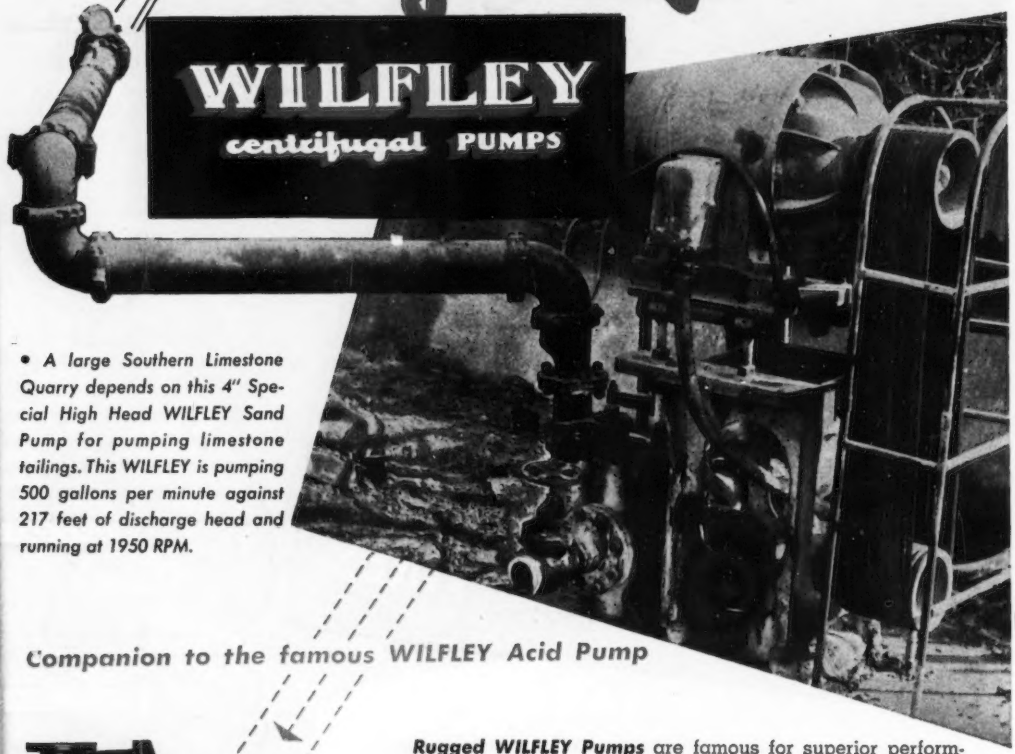
FOR

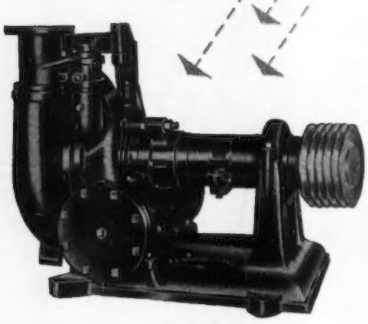
tailings disposal

WILFLEY
centrifugal PUMPS



• *A large Southern Limestone Quarry depends on this 4" Special High Head WILFLEY Sand Pump for pumping limestone tailings. This WILFLEY is pumping 500 gallons per minute against 217 feet of discharge head and running at 1950 RPM.*

Companion to the famous WILFLEY Acid Pump



Rugged WILFLEY Pumps are famous for superior performance—wherever sands, sludges, slurries, slimes or abrasive solutions of any kind must be handled efficiently and economically.

Now the new WILFLEY Model K Centrifugal Sand Pump offers important mechanical improvements—engineering refinements which save you even more dollars on the production line and in power...give stepped-up performance and low-cost operation...easy interchangeability of wear parts and low maintenance. Investigate the new Model K for trouble-free, intermittent or 'round-the-clock service on your job. Every application individually engineered. Write or wire for Bulletin 200 on the new Model K.

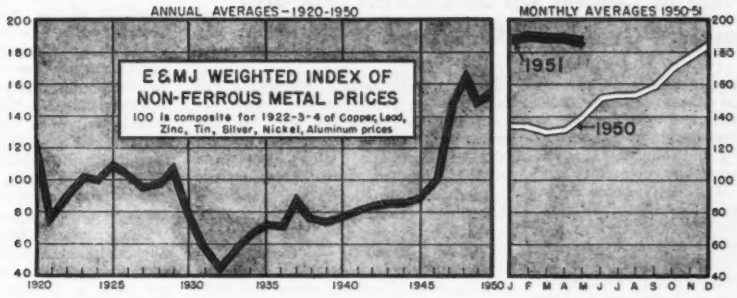
A. R. WILFLEY & SONS, INC.

DENVER, COLORADO, U.S.A. • NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

BUY WILFLEY FOR *Cost-Saving* PERFORMANCE

E&MJ OUTLOOK

PRICES



MARKETS

Another slight dip in the E&MJ Index of non-ferrous metal prices carried no weight marketwise. It lost 0.71 point, settling at 189.47 for May. Again the ripple was caused by tin, now under RFC control.

Pressure for a higher copper price is increasing, thanks to the State Department's intervention in Chile's request for a 3¢ hike. Our foreign quotation rose on sales by the leading Chilean producer, London followed, and others operating in a more or less free market cannot be far behind.

Higher labor and production costs amounting to $15 million a year at Inco raised nickel prices 6¢ per pound effective June 1.

•

LABOR

Real competition is beginning for mining's skilled labor with opening of seasonal industries and bidding by holders of Government contracts. This is crucial.

Mine, Mill wants to be first to smash what's left of Government wage controls with 30¢ an hour increases this year. They'll take less.

•

AT HOME

With wages headed up and prices nailed down, business generally seems headed for a profit squeeze. The economy at large is headed for another whirl on inflation's merry-go-round.

If the proposed zinc subsidy (see p. 104) goes through, look for its evolving into another Premium Price Plan. Adjusting inequities in this scheme would give Washington left-wingers an opening for profit control.

Planned growth in aluminum production is likely to exceed that of copper, lead, and zinc combined. Civilian supplies of aluminum probably won't go below 1950 levels, a strong competitive point.

Put Chemical Construction Corp's **new ammonia leaching process** in the "shape-of-things-to-come" class. At Sherritt-Gordon's Lynn Lake project, it will yield nickel, copper, and cobalt from leach solutions as finely-divided pure metal precipitates. (See p. 142.)

If Congress okays Government defense plants, one of the first will be a **$15 million plant to produce titanium metal.**

•

ABROAD

World-wide competition for metals is rapidly developing into an expensive scramble. Copper, in perfectly legitimate markets outside the U.S., has sold recently at 49¢ a pound.

State Department's deal with Chile on copper prices has created a "situation" only curable by raising domestic ceiling to the same level.

MARKETS—Trends and Prices

World Price of Copper Up as Chilean Producer Passes on 3c. "Grant"—U.S. Suspends Tariff

PRODUCERS AND CONSUMERS of nonferrous metals paid no attention to increasing nervousness over possible favorable political developments outside of this country and the general unsettlement in speculative commodity markets. During May, restrictions on use imposed by the National Production Authority became even tighter and there were no indications as the month ended that costs will come down. In brief, inflationary pressures continued.

An insignificant downward revision in the E & M J index of non-ferrous metal prices, to 189.47 in May, resulted entirely from a lower average for tin now controlled by RFC. A higher market for foreign copper, set off by the recent agreement between government officials of Chile and the United States, exerted no influence on our index as only the domestic quotation for the metal is a component of this indicator. The leading Canadian producer advanced nickel 6c. per pound, effective June 1, to compensate for substantially higher labor and production costs.

Industrial production in the United States for April was estimated by the Federal Reserve Board at 222% of the 1935-39 average, the same as in the preceding month. Despite a drop in automobile production, the index for May, when available, is expected to show little change.

Chilean Copper Rises

The involved problem of passing on the 3c. per pound "grant" to Chile without colliding with the United States pricing regulations was solved by the leading Chilean producer by the sale of its copper through Chile Exploration, operating in Chile. Beginning May 21, that affiliate of Anaconda began selling Chilean copper for consumption in the United States market on the basis of 27½c. per pound, delivered Connecticut Valley. Because the sales were closed outside of this country, they naturally influenced our export or foreign quotation. The sales, worked back to the U. S. f.o.b. refinery equivalent, called for the deduction of .250 points from the delivered Valley basis, which varied only slightly from our normal .300 deduction on deliveries for the so-called New England area.

Kennecott is expected to become a seller of its Braden production as soon as necessary machinery can be set up for handling such sales in Chile.

The impact on the world copper market of this move was pronounced. The British Ministry of Supply marked up its home quotations for copper £24 per long ton, effective May 25. The rise to £234 per long ton takes care of the 3c. advance in Chilean copper and will be reflected in higher contract prices paid to Rhodesian producers. Leading Canadian producers are expected to advance their quotations by a similar amount.

Most observers contend that the United States' ceiling price will have to advance sooner or later to get away from a two-price system for the bulk of the world's production. Custom smelters treating foreign ores and concentrates have asked for price relief. They maintain that substantial tonnages of copper-bearing material now moving into this country will be diverted to foreign plants without a realistic approach in the matter of pricing foreign-origin copper in this market.

C. Donald Dallas, chairman of Revere Copper and Brass, declared that officials should raise the domestic ceiling price to the 27½c. basis to halt the siphoning out of copper from this country's normal sources of supply.

Endicott R. Lovell, president of Calumet & Hecla, holds that the domestic price of copper must be raised if the industry is to operate effectively. "It is unfair to domestic producers, and especially the marginal producer, to be obliged to accept a Government ceiling price lower than that paid foreign producers," he told a gathering of security analysts.

The price of copper, in a truly free market, probably would rise to the highest levels recorded in modern times. Some consumers situated outside of this country, unable to obtain even a limited supply except by disregarding all quoted prices, have paid all the way from 40c. to 60c. per pound. Hope for a world accord in pricing and distributing copper appears to be slim. The exploratory meetings held in Washington disclosed that the requests for copper from countries that took part in the discussions far exceeded the available new supply. Naturally, the participants asked for all of the copper called for under expanding defense and civilian programs.

Suspends Copper Duty

President Truman signed the measure suspending the import duty of 2c. per pound on May 22. The law suspends the duty during the peroid beginning April 1, 1951, and ending with the close of Feb. 15, 1953, or the termination of the national emergency proclaimed by the President on Dec. 16, 1950, whichever is earlier: provided that when, for any one calendar month during this period the average market price has been below 24c. per pound, delivered Connecticut Valley, the suspension is to be revoked by the President. Engineering and Mining Journal's Metal and Mineral Markets will be used to determine the monthly average market price of copper.

The American Brass Co. has notified its customers that credits will be issued for proportions of imported copper used in products covered by invoices dated April 1 and subsequently.

Production of crude copper in the United States in April totaled 91,055 tons, of which 83,708 tons was primary and 7,347 tons secondary. Production of refined copper in this country in April amounted to 103,494 tons, against 112,933 tons in March.

During April, fabricating plants consumed 119,172 tons of refined copper, which compares with 113,963 tons in March. Stocks in hands of fabricating plants dropped slightly.

Average Prices for May (E&MJ Quotations)

Copper:	
Refinery	24.200
Electrolytic, Export, Refinery	25.471
Lead:	
Common, New York	17.000
Common, St. Louis	16.800
Silver and Sterling Exchange:	
Silver, New York, per oz.	90.160
Silver, London, pence per oz.	78.500
Sterling Exchange, "Checks"	280.000
Zinc:	
Prime Western, East St. Louis	17.500
Tin:	
New York Straits	139.923
New York, 99% min. (e)	138.923
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$212.923
Antimony (E&MJ) (d)	45.300
Antimony, bulk, Laredo	42.000
Antimony, in cases, Laredo	42.500
Platinum, refined, per oz.	$90.000
Cadmium (a)	255.000
Cadmium (b)	267.500
Cadmium (c)	280.000
Aluminum, 99% plus, ingot	19.000
Magnesium, ingot	24.500
Nickel (f)	50.500

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotation.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lot, packed in cases, f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.

Tariff Rates Cut

The results of the Torquay tariff agreement, announced early in May, contained more than one surprise. The lead industry learned that Canada and Peru were granted concessions that will lower the import duty on the metal to three-quarters of a cent per pound for lead contained in ore, etc., and to 1 1/16c. on pig lead, effective June 6.

The Torquay rate on zinc is 3/8c. per pound on metal contained in ore and 7/10c. on slab zinc, also effective June 6. Under the same pact, the duty on aluminum drops from 2c. per pound to 1 1/2c.

At the annual meeting of the Lead Industries Association, held in New York, a resolution addressed to the Government calls for the temporary suspension of the import duty on lead, with proper safeguards, as in copper.

Producers of zinc have been asked by NPA to set aside larger tonnages for the acceptance of defense rated orders. In addition, sellers of both zinc and lead will have to allow for an additional 5% reserve with which to meet hardship cases.

Tin of Straits quality was reduced in price by RFC on May 10 to $1.39 per pound, a drop of 3c. Singapore prices averaged several cents per pound higher than the U. S. quotation.

Quicksilver was unsettled on increased offerings from outside sources. Domestic output is gradually increasing. Though consumption was higher in the first quarter of the year, demand since then has been on the decline. The price settled at $212 per flask, off $3 for the month.

Antimony and platinum traders have appealed to OPS for higher ceiling prices.

Major Metals

U. S. DAILY AND AVERAGE PRICES

May 1951	Electrolytic Copper (a) Domestic	Electrolytic Copper (b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	24.200	24.425	142.000	17.000	16.800	17.500
2	24.200	24.425	142.000	17.000	16.800	17.500
3	24.200	24.425	142.000	17.000	16.800	17.500
4	24.200	24.425	142.000	17.000	16.800	17.500
5	No Market	24.425	142.000	17.000	16.800	17.500
7	24.200	24.425	142.000	17.000	16.800	17.500
8	24.200	24.425	142.000	17.000	16.800	17.500
9	24.200	24.425	142.000	17.000	16.800	17.500
10	24.200	24.425	139.000	17.000	16.800	17.500
11	24.200	24.425	139.000	17.000	16.800	17.500
12	No Market	24.425	139.000	17.000	16.800	17.500
14	24.200	24.425	139.000	17.000	16.800	17.500
15	24.200	24.425	139.000	17.000	16.800	17.500
16	24.200	24.425	139.000	17.000	16.800	17.500
17	24.200	24.425	139.000	17.000	16.800	17.500
18	24.200	24.425	139.000	17.000	16.800	17.500
19	No Market	24.425	139.000	17.000	16.800	17.500
21	24.200	27.250	139.000	17.000	16.800	17.500
22	24.200	27.250	139.000	17.000	16.800	17.500
23	24.200	27.250	139.000	17.000	16.800	17.500
24	24.200	27.250	139.000	17.000	16.800	17.500
25	24.200	27.250	139.000	17.000	16.800	17.500
26	No Market	27.250	139.000	17.000	16.800	17.500
28	24.200	27.250	139.000	17.000	16.800	17.500
29	24.200	27.250	139.000	17.000	16.800	17.500
30	Holiday	27.250	Holiday	Holiday	Holiday	Holiday
31	24.200	27.250	139.000	17.000	16.800	17.500
AVERAGES FOR MONTH						
May	24.200	25.471	139.923	17.000	16.800	17.500
AVERAGES FOR WEEK						
May						
2	24.200	24.425	142.000	17.000	16.800	17.500
9	24.200	24.425	142.000	17.000	16.800	17.500
16	24.200	24.425	139.000	17.000	16.800	17.500
23	24.200	25.838	139.000	17.000	16.800	17.500
30	24.200	27.250	139.000	17.000	16.800	17.500
CALENDAR WEEK AVERAGES						
May						
5	24.200	24.425	142.000	17.000	16.800	17.500
12	24.200	24.425	140.500	17.000	16.800	17.500
19	24.200	24.425	139.000	17.000	16.800	17.500
26	24.200	27.250	139.000	17.000	16.800	17.500

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

May 1951	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	280.000	90.160	78.500d.	248s.	$35.00
2	280.000	90.160	78.500d.	248s.	35.00
3	280.000	90.160	78.500d.	248s.	35.00
4	280.000	90.160	78.500d.	248s.	35.00
5	(e)	(e)	(e)	(e)	35.00
7	280.000	90.160	78.500d.	248s.	35.00
8	280.000	90.160	78.500d.	248s.	35.00
9	280.000	90.160	78.500d.	248s.	35.00
10	280.000	90.160	78.500d.	248s.	35.00
11	280.000	90.160	78.500d.	248s.	35.00
12	(e)	(e)	(e)	(e)	35.00
14	280.000	90.160	Holiday	Holiday	35.00
15	280.000	90.160	78.500d.	248s.	35.00
16	280.000	90.160	78.500d.	248s.	35.00
17	280.000	90.160	78.500d.	248s.	35.00
18	280.000	90.160	78.500d.	248s.	35.00
19	(e)	(e)	(e)	(e)	35.00
21	280.000	90.160	78.500d.	248s.	35.00
22	280.000	90.160	78.500d.	248s.	35.00
23	280.000	90.160	78.500d.	248s.	35.00
24	280.000	90.160	78.500d.	248s.	35.00
25	280.000	90.160	78.500d.	248s.	35.00
26	(e)	(e)	(e)	(e)	35.00
28	280.000	90.160	78.500d.	248s.	35.00
29	280.000	90.160	78.500d.	248s.	35.00
30	Holiday	Holiday	78.500d.	248s.	Holiday
31	280.000	90.160	78.500d.	248s.	35.00
AVERAGES FOR MONTH					
May	280.000	90.160	78.500d.	—	$35.00
AVERAGES FOR WEEK					
May					
2	280.000	90.160	—	—	—
9	280.000	90.160	—	—	—
16	280.000	90.160	—	—	—
23	280.000	90.160	—	—	—
30	280.000	90.160	—	—	—

Calendar week averages, New York Silver: May 5th, 90.160; 12th, 90.160; 19th, 90.160; 26th, 90.160.
(e) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.30c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West, effective Jan. 1, 1951, commanded a premium of 1.35c. per pound over the current market for Prime Western; Special High Grade 1.50c.

Quotations for lead are for domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harmon is for silver contained in ores and other unrefined silver-bearing materials, in cents and fraction of a cent fractions per troy ounce. It is determined by Handy & Harmon on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver is 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Behind the By-Lines . . .

G. P. Luljon

» **Fortunately it was one of our most nimble editors** who ventured underground at the Callahan Zinc-Lead Mine in Idaho. Miners there are so anxious to get the lead out, that if he hadn't been alert, he certainly would have been run over by an ore car. As it was, he not only survived, but persuaded Mine Superintendent **James Dunn** to write a story on how come the boys there are so eager. The result, "Successful Incentive Plan for Small Mines," appears on page 85.

At Callahan Zinc-Lead the miners are paid for almost everything practically down to the last wedge. You might think this would involve a lot of bookkeeping. If you do, you're in for a surprise. Furthermore, the incentive plan resulted in lower unit costs and at the same time, raised the miners' take-home pay. What more can you ask of any incentive system?

The accent is also on small mines on page 90 where **J. C. Kieffer,** manager of Spokane-Idaho Mining Co., tells how a group of small mines in the Pine Creek area made good—in fact made that area the major zinc producing district in Idaho, a zinc-producing state from way back.

» **We're probably leading with our chins,** but we want to get some information and you're the only one who can give it to us. We want to find out what you think of this issue of E&MJ. To make it easy, we have put a stamped, self-addressed card opposite page 126 with a set of instructions. There's not much to it; just a few pencil marks on the card, tear out, and mail. Shouldn't take you more than three (3) minutes and returns will be useful in helping us improve E&MJ, to furnish even more service to readers.

With some trepidation we call your attention to lines left on the bottom of card for any comments you may think appropriate. You may fire when ready; no blindfold, thank you.

» **Who benefits most** from operation of a mine? C. J. Parry of J. A. Hogle & Co., makes an interesting point in a news letter from Salt Lake. He takes the case of Sunshine Mining Co. which produced $8¼ million in new wealth in 1950. Stockholders benefited by receiving $1,116,615.75 in dividends. The Government benefited by more than a million dollars paid directly in taxes. Beyond this, the stockholders' dividends were subject to tax as was the $3½ million paid to labor.

That's not all! The Government purchased $7,504,212.94 worth of silver at 90½ c. per oz. It then issued currency at the rate of $1.30 per oz., making a further profit of $3,275,319.46 on Sunshine's effort.

Mr. Hogle concludes, *"In view of these facts, it is easy to see who benefits most from a successful mining operation, but it is most difficult to account for the hostile and unfriendly attitude of certain interests toward the mining industry as evidenced by aid given to foreign mining operations."*

While we take several exceptions to Mr. Parry's blanket conclusion, the figures he cites certainly illustrate some flaws in the Government's reasoning on some of its domestic policies concerning the mining industry.

» **Talk, talk, talk!** Figures recently released show that the Iron Curtain countries did 41% of the talking in the United Nations meetings in 1950 and paid about 10% of the costs of maintaining the organization. The U. S. did 4% of the talking and picked up the tab for 39% of the costs. That's about par for the course in international affairs these days.

It's nice to think that there was a time when our business acumen was a little more acumener. For example, there is a little deal back in 1867 that is worth noting. We purchased Alaska from Russia for $7,200,000. Each year since 1900, except for 1944, the value of Alaska's mineral production has exceeded that figure.

» **Chain letters** are apparently back in vogue this season, but last week an E&MJ editor got a chain letter which should end all chain letters.

"This chain was started in the hope of bringing happiness to all tired business men. Unlike most chains this one does not require money. Simply send a copy of this card to five married male friends. Then bundle up your wife and send her to the fellow who heads the list.

"When your name comes to the head if the list, you will receive 188 women . . . some of them ought to be dandies. Have faith . . . don't break the chain. One fellow broke the chain and got his wife back!"

» **Deflation Note:** We cleaned out some desks around the shop last week and along with one slightly used yo-yo, two mandolin strings, and an old joke book, we found an 1880 subscription blank for E&MJ. The price noted was $4.00 per year—and that's when a dollar was a dollar. Today, in comparison, four iron men will get you E&MJ for *two* years. Just fill out the—oh, never mind!

The joke book was real snappy, too, as witness the following:

Brooklyn sailor—Whad ya do before ya jerned de Navy?

Mid-Westerner—I worked in Des Moines.

Brooklyn sailor—What kinda moines, coal or iron?

» **If you were slightly puzzled** by the "binder twine" rider that the Senate hooked on to the copper tariff proposition, consider the bewilderment of people in other lands who are not so familiar with the mysterious ways in which the American Congress works, nor with the intricacies of the English language. Here's a letter received from a mining and smelting company in Japan after E&MJ Metal & Mineral Markets reported the binder twine deal.

". . . Now we wish to inform you that we have just received your edition dated May 3, 1951 . . . and among the articles we found the words that we could not understand by any means. That is "binder twine" on the first page, regarding the problem of copper tariff.

"We should be very pleased if you are so kind to let us know the meaning of the words "binder twine" at your earliest convenience . . ."

Excuse us while we add to this gent's confusion.

ENGINEERING AND MINING JOURNAL

JUNE, 1951

Small Mining Needs Action, Not Conversation

MR. SMALL MINER, you have numerous friends, and apparently no enemies. Many of your friends are of long standing, and have wept enough tears in your behalf to make a fair-sized lake. Nevertheless, all these willing, helping hands have accomplished but little in improving your lot. As far as we can observe, the big ones continue to get bigger and the little fellows are up against increasingly difficult conditions.

Why are the times so tough in small mining, as they are on small business generally? First, the tax laws, hard as they are on everybody, make it harder for the little fellow to gain recognition of his losses. He gets no benefit from consolidation of returns, is likely to lose more from the limitations on carry-over rights, is more severely hurt by the necessity of capitalizing development expenses, is more deeply cut by the 50% of net profit limitation on depletion allowances (having, in general, less profit), and lacks the expert talent necessary to cope with the Bureau of Internal Revenue.

Moreover, high taxes in general have tended to dry up wealth in the pockets of people to whom the small miners used to look for financial assistance. Also, the tax law features which limit recoupment of losses have reduced the interest of investors in long-risk enterprises.

Another important reason is that mineral prices in general have been too low in recent decades. In a sense, the good mines last too long, which is another way of saying that the people who possess the good mines have in general been willing to liquidate their depletable assets too cheaply. They have looked at acquisition and operating costs rather than replacement costs and as a result their offerings have tended to hold mineral prices to levels at which the small miner suffers hardship.

Probably the one condition that would help the small miner most would be more favorable, stable prices for minerals. Outside of socialism, this can only be accomplished either by compacts to stabilize prices—at present illegal in the U. S.—or by general realization by producers that they are liquidating their depletable assets too cheaply.

The next best aid for the small miner would be tax improvements along the lines recommended in the six-point tax program of the National Minerals Advisory Council (*E&MJ*, Mar., 1950, p. 57). These would not only help the small miner directly, even though not selectively, but would supply incentives to those potential investors to whom he logically can look for financial participation.

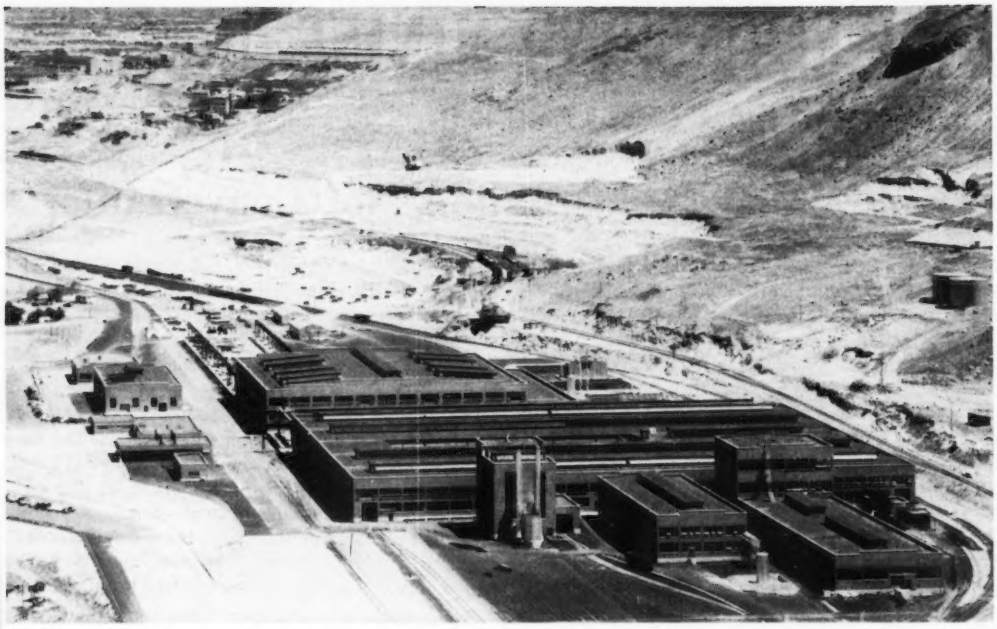
Then, until and unless the rate of new discoveries improves, we believe an exploration-development assistance plan similar to the one now in existence under the Defense Production Act would be a wise aspect of Government policy. Sound aspects of this plan which should be preserved are: (a) mandatory financial participation by the applicant; (b) repayment in case of success; (c) technical scrutiny of each project on its own merits, and (d) intentional discrimination, if any, based only on essentiality of mineral produced.

Then, there are probably some ways in which small miners can collectively realize some of the advantages now available only to large enterprises. Possibly in order to support such facilities financially, some contributions could be obtained from state governments or from state or regional mining associations, as has been done in Arizona and is now working well in Ontario. The advantages we have in mind are to provide, at rates the small miner can afford, competent consultants according to need on engineering, geology, freight rates, taxation, and legal problems. The small miner in certain instances could also profit by joint purchasing, warehousing, maintenance and ownership of equipment not constantly used.

The small miner, and all mining, can profit by showing more interest in good ideas from outside. In this issue, for example, is portrayed an incentive system that may look complicated at first glance, but is actually succeeding at small mines. The small miner, resourceful as he usually is, can profit from being receptive to other people's ideas.

These suggestions probably will not overcome all handicaps. However, at present we have nothing else to offer which would not in the long run either reduce the virility of an admirable breed or make the small miner a pawn of bureaucracy.

In short, we recognize the fostering of small mining as a real problem and would like to see it become the subject of constructive action rather than mere conversation and political posturing. What we offer here is at least a start toward a constructive program. If you have something additional or better to offer, please write us.



PLANT EXTERIOR shows careful planning for appearance, as well as material flow to, through, and from refinery.

Improved Plant Design

Here are the facts on the West's newest electrolytic copper plant presented by the man who was responsible for its advanced design.

STANLEY HUGHES
Consulting Engineer
Kennecott Copper Corporation
Garfield, Utah

BUILT FOR PERFORMANCE, economical upkeep, and low operating costs, the new electrolytic copper refinery of Kennecott Copper Co. at Garfield, Utah, represents a combination of the best ideas obtainable from study of other active refineries, together with original ideas developed during our design work.

When the switch was closed on the stripper circuit July 31, 1950, it marked the completion, for the Salt Lake mining area, of the full copper "production line" from ore to refined wire bars. The economic significance to the West, and to the Nation, of this new Western source of refined copper is, of course, tremendous. It is not in the scope of this article, however, to discuss that aspect of the new refinery. It is my purpose to present only the technological elements of the new refinery's design and operation.

The refinery area occupies more than 40 acres of land just above Garfield, about midway between the company's Arthur concentrator and the Garfield smelter of American Smelting & Refining Co.

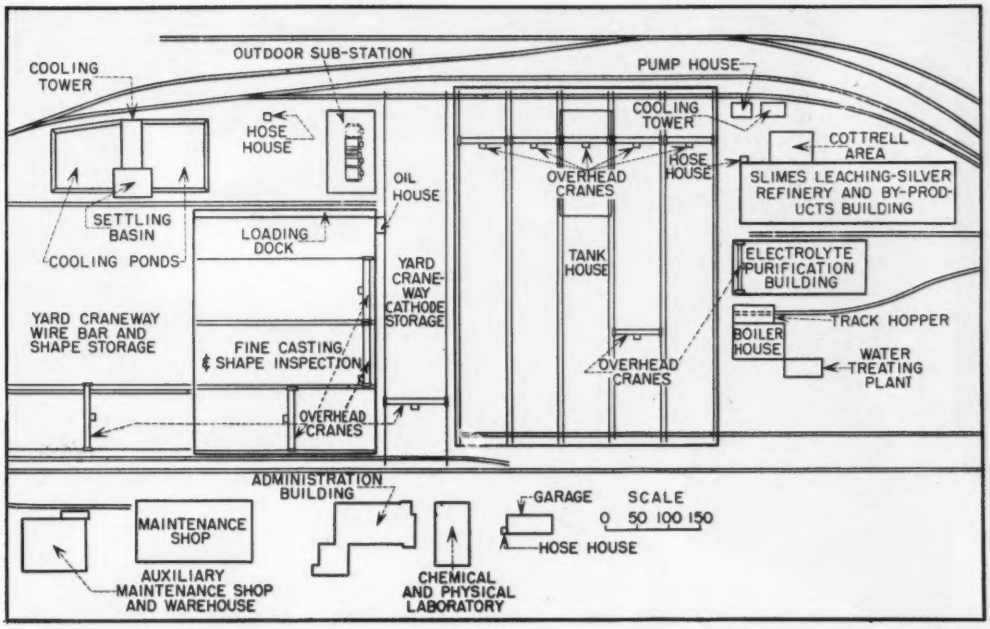
The plant buildings cover about 13 acres. The space between buildings, and large areas beyond them, are covered with asphalt to hold down dust and to provide parking areas. A network of railway track connects all parts of the plant to the line running between the concentrator and the smelter. This connection also gives access to the main lines of the Union Pacific and the Denver and Rio Grande Western. A general plan of the plant is shown above, together with an air view of the plant area.

Maximum capacity of the new refinery is 16,000 tons of copper per month, but there is ample room for expansion should it ever become necessary. At present, the production is at a rate of 12,000 tons monthly.

The Tank House

The tank house is divided into five 80-ft. crane bays, with the center bay occupied by the generator room, shower, locker, and lunch rooms, together with offices. These are all on the cell floor level. The pump stations and electrolyte storage tanks are in the basement. The roof over most of this section is at low level to provide natural ventilation and permit light to enter the center of the tank house.

Equipment contained in the generator room consists of six identical motor-generator sets, each made up of one 2,900-hp., .8 pf., 3-phase, 60-cycle, 514-rpm. synchronous motor driving two 1,000-kw., 125-v., shunt-wound, d.c. generators; one



PLANT LAYOUT identifies buildings shown opposite. Note rail access to ends of tank house for easy anode delivery.

Marks New Utah Refinery

25-kw., 125-v., d.c. exciter for the synchronous motor; and one 15-kw., 125-v. exciter for the two generators. Five of these units are in constant operation, with three furnishing power to three commercial cell lines, one serving the stripper section, and one the electrolyte purification section, which is in a separate building. The spare set may be switched through a transfer bus to replace any other set.

Temperature and humidity of the air in the generator room are carefully controlled by a mechanical air conditioning system to insure satisfactory commutation and brush life. It has been found that low humidity shortens brush life.

Air Conditioned

Air is drawn into the makeup room from an outside duct where it is filtered, washed, and blown into the generator room. The generator sets have enclosing covers and take air in at the ends of the machines, with the heated air being discharged into enclosures under each set in the basement. From beneath each set the air is drawn into the basement through a two-section, air-to-water heat exchanger by a fan and discharged successively into a common duct and through grilled openings to the generator room. The six sets of heat exchangers have a separate cooling tower, and about 1,500 gpm. of 90° F. water is required to keep the temperature of the generator room from exceeding 100° F.

Cell Installation

The tank house contains a total of 1,346 electrolytic cells arranged in 38 sections of 34 cells, one section of 30 cells, and one section of 24 cells. Cell arrangement, electrically, consists of three main commercial circuits, each containing 408 cells. Another circuit of 122 cells is provided, all or part of which may be used for making starting sheets. This circuit contains the two smaller cell sections (30 and 24) mentioned to give some flexibility in the matter of starting sheets for various rates of operation. Each of the three commercial circuits is divided into two separate electrolyte circulating systems of 204 cells each, and the stripper circuit of 122 cells is a single separate electrolyte system.

The cells are individual and are of reinforced concrete monolithic construction, measuring 13 ft. 6¾ in. by 3 ft. 6¾ in. by 4 ft. 1 in. inside the lead lining. All were made in a special plant at the refinery site employing the vacuum process, requiring a minimum of form work. The concrete columns supporting the cells and some other concrete shapes used in plant construction were also precast, using the vacuum process. The cell columns were set up at required points and grouted in place, and in order to insulate the cells from the ground the columns are capped with 4-in. vitrified brick with an overhanging lead shield as protection against spillage.

The direct-current energy for the cell lines is taken from the generators through metal-clad switch gear containing the necessary disconnecting switches and air circuit breakers to a system of main busses in the basement of the tank house. These busses are made up of eight ½ x 10-in. flat copper bars spaced ½ in. apart for ventilation

ANODES come from A. S. & R.'s new anode-casting plant at Garfield. This is refinery's own Walker casting wheel for anode scrap, melted in 15-ft. magnesite-lined Lectromelt furnace with 6,000-kva., 13,800-v. transformer.

and mounted vertically in Micarta blocks.

Connection between the main bus and the cells is made with copper riser bars. The end cell connections are in the form of a tapered bus built up of varying lengths of ½ x 10-in. copper bars connected to a bent copper plate to which is attached a triangular bar to support the anodes and cathodes.

Anode Supply

Anode spacing, while operating the refinery on a 12,000 ton-per-month production basis, is 4⅜ in. center to center, permitting a cell load of 36 anodes and 35 cathodes. When it is desired to raise production to 16,000 tons, then anode spacing will be reduced to 3⅞ in., and the cell load will be 41 anodes and 40 cathodes.

The anodes are cast at the new anode casting plant completed at the Garfield smelter of the American Smelting and Refining Co. just before start of operations at the refinery. Here refinery inspectors supervise weighing and sampling of anodes, and prepare reports for departments concerned.

Commercial anodes weigh 700 lb. and stripper anodes 800 lb. Both are transported to the refinery in standard-gage special rack cars designed and built at the company shops and holding 108 anodes spaced on 4⅜-in centers. Here, rail tracks extend across both ends of the tank house so that overhead cranes can remove the anodes in groups of 36 and place them directly into the cells, thereby eliminating intermediate handling.

Electrode Support

Excluding the lugs, the anodes are 35 in. wide, 39 in. long, and about 1⅝-in. thick. The Baltimore groove is used in the contact lug with a special shaped cathode suspension bar, and, save for the end cells where they rest on the bus bar, the anodes rest on a 1-in. triangular section equalizer bar on each side of all cells.

Cathode Data

Cathodes measure 37 in. in width and 41 in. in length, and their production follows standard methods. The starting sheets, upon which the subsequent cathode deposit is built up, are made by depositing thin sheets of electrolytic copper for about 24 hr. on rolled copper blanks lightly oiled so as to prevent adherence of the deposit. Resultant thin sheets weighing about 10 lb. are stripped by hand from the blanks, flattened in a roll-leveller, and single, wide loops are attached, through which the special shaped bar is threaded for suspension in the cells.

The anode age is about 28 days, and two pullings of cathodes are made at 14-day intervals. At the

time of the second pulling, the anodes have been corroded away, leaving about 15% of the original weight. The anode scrap is washed, removed from the cells, and sent to the casting house to be melted and recast into full-weight anodes. At the current 12,000 ton-per-month production rate, the tank house operates at a current density of about 16 amp. per sq. ft. of cathode surface.

Electrolyte Composition

Circulating electrolyte enters each cell through a rectangular feed tube extending nearly to the bottom of the cell at one end and overflows over a weir at the opposite end of the cell. The electrolyte is heated by pumping it through Karbate tube heat exchangers installed on the working floor level of the tank house. It is then elevated to constant-head tanks, whence it flows by gravity to the cells.

As raw water received at the refinery is too high in chlorides to be used in the tank house, condensate recovered from the heat exchangers is used for all washing and makeup purposes. Temperature of the electrolyte fed to the cells is maintained at 140° F., and circulation rate at 4 gpm. per cell.

The electrolyte carries about 40 g/1 copper in the form of copper sulphate and 200 g/1 sulphuric acid. It is proposed to limit arsenic content to a maximum of 5 g/1, and nickel to a maximum of 12 g/1. Arsenic content is controlled by electrolytic deposition, using lead anodes, and nickel sulphate is recovered from decopperized electrolyte in direct-fire evaporators.

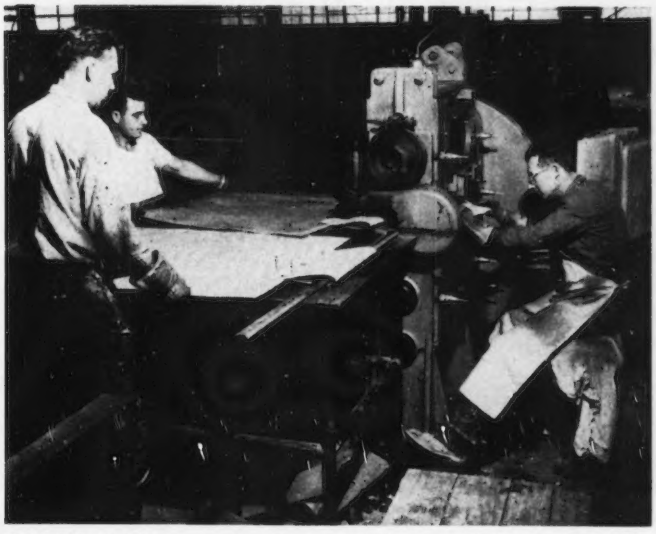
The electrolyte storage tanks, as well as the 1,000-gpm. alloy pumps used for circulating the electrolyte, are in the basement of the tank house. The tanks are elevated somewhat above the basement floor, permitting electrolyte to flow by gravity to the pumps.

A number of smaller alloy pumps are provided for transferring electrolyte from one system to another, and to the electrolyte purification plant. The piping of each of the seven circulating systems is carried separately and is insulated from other piping, from ground, and building by means of wooden cradles extending through all suspension brackets and hangers.

Sufficient electrolyte storage is provided to accommodate the volume of those sections shut down for removal of slimes, as well as to take normal overflow from all cells in the tank house in the event of a complete shutdown of pumps because of power failure.

Thorough washing of cathodes is very important to minimize introduction of sulphur in the form of electrolyte into the electric melting furnaces. After the cathodes have been drawn from the cells they are dipped successively in two tanks of water, in which the water is strongly agitated by pumps. Rewashing follows in a cathode washing and unloading machine, first with a hot, recirculated water spray and finally with a clean water spray, which is not recirculated. Washed cathodes are trucked to the casting house.

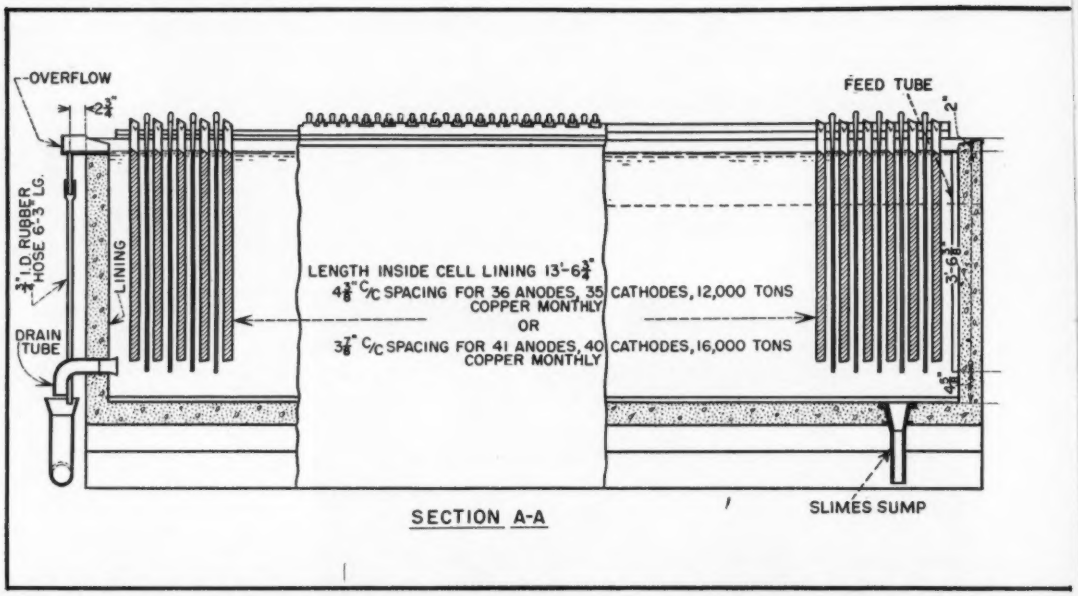
STARTING SHEETS, for cathodes, result from 24-hour deposition on rolled copper blanks. Sheets weigh about 10 lb., make cathodes 37 in. wide, 41 in. long.



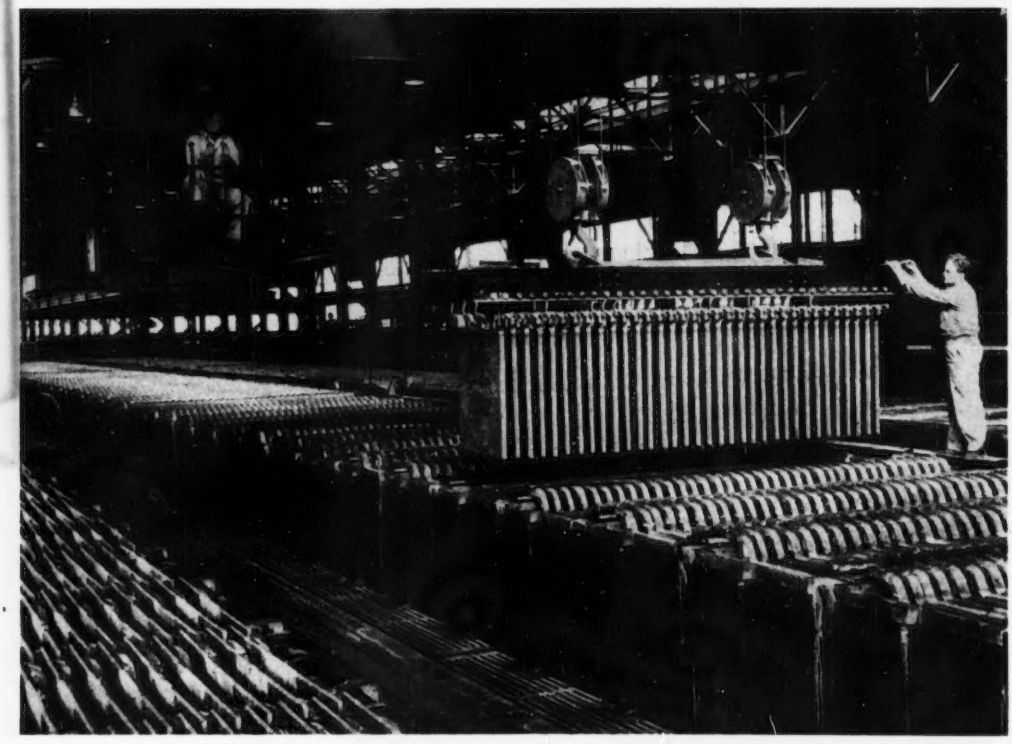
TACKING LOOPS on starting sheets. Cathodes are pulled every two weeks.

Electrolyte Purification Plant

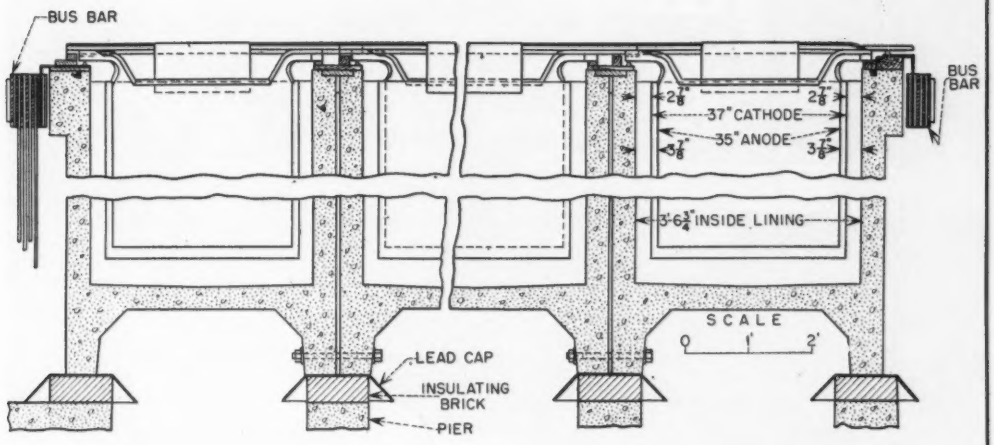
The building housing the electrolyte purification plant is adjacent to the tank house and between the


OVERFLOW
FEED TUBE
1" I.D. RUBBER HOSE 6'-3" LG.
LINING
DRAIN TUBE
LENGTH INSIDE CELL LINING 13'-6¾"
4⅜" C/C SPACING FOR 36 ANODES, 35 CATHODES, 12,000 TONS COPPER MONTHLY
OR
3⅞" C/C SPACING FOR 41 ANODES, 40 CATHODES, 16,000 TONS COPPER MONTHLY
SLIMES SUMP
SECTION A-A

ELECTRODE ARRANGEMENT, and other features of cel l design, shown in cross section. Electrodes are supported by



BATCH OF ANODES from Garfield smelter goes into tank. For easy handling, they are sent to refinery on special racks, are lifted right into tanks. Anodes weigh 700 lb., last about 28 days, leave 15% scrap to be remelted.



contact lugs with Baltimore groove. Electrolyte enters cell at bottom (right), overflows weir at left at 4-gpm. rate.

boiler house and anode slime treatment plant. All liberator cells are in this building, none being used in the main tank house.

Equipment in operation in the plant consists of 36 standard concrete cells arranged in cascades, using a separate generator and electrolytic circuit. Lead anodes are used in the cells. The cascades are placed in two rows, one consisting of 5 groups of 4 cells and the other of 4 groups of 4 cells. By changing the inlet and outlet setups of these different groups of cells it is possible to use them in various combinations of 4 cells up to 20 cells as a single cascade.

Where complete decopperization is required it is necessary to use at least 12 cells in cascade, otherwise cells are used in cascades of 4 to avoid production of spongy cathodes in the cells at the outflow end of the cascade. Impure acid resulting from evaporation of decopperized electrolyte for nickel removal is shipped for use outside of the refinery.

Casting House

The casting house is divided into three 100-ft. crane bays and one 60-ft. lean-to bay. Ample space is provided for the melting, casting, cutting, sampling, and compressor equipment installed, and for storage and loading. The entire floor of the building is paved with reinforced concrete, encouraging cleanly operation and facilitating moving the metal about.

Essentially, the furnace equipment consists of three 15-ft., size "M" Lectromelt furnaces, two of which are used for melting cathodes, and one for remelting anode scrap.

The casting units below the furnaces are standard Walker casting wheels. Two measure 40 ft. in diameter and are used for producing refined shapes, while the third, 24 ft. in diameter, produces anodes. All these units are served by the overhead crane operating in the center bay. The cranes adjoining on the left and right serve the charge mechanisms of the furnaces, and for inspection and loading of refined copper shapes. The electric furnaces are lined with magnesite brick, 26 in. on the bottom, 18 in. in side walls, and roofs 9 in.

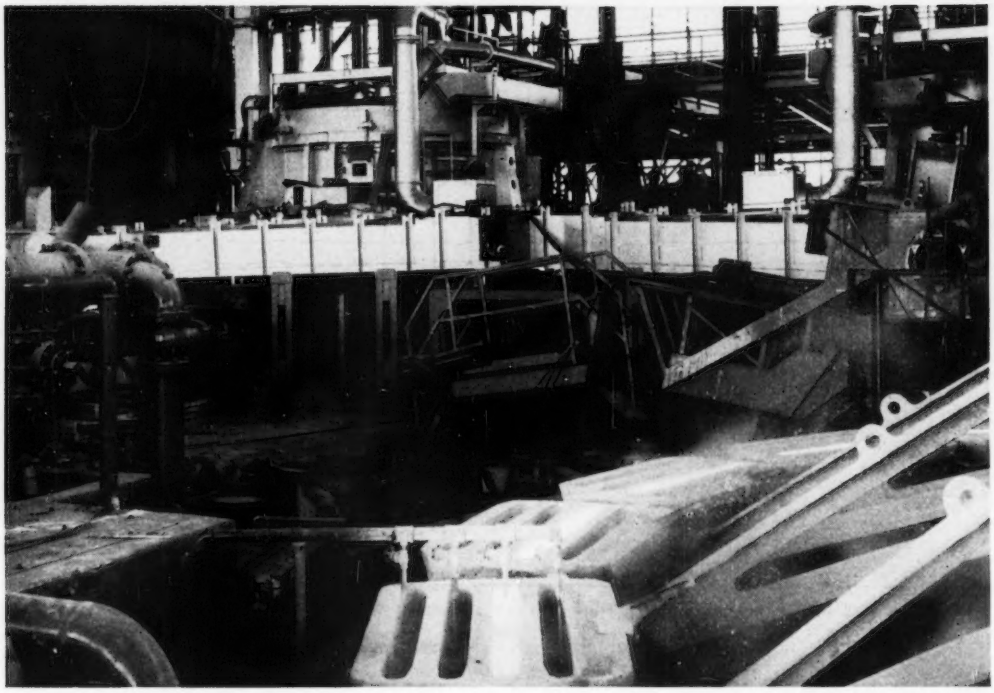
The furnaces are equipped with 6,000-kva., 13,800-v. transformers with 12 secondary taps ranging from 85 to 225 v. Graphite electrodes, three per furnace, are 14 in. in diameter, but consideration is being given to the use of 17-in. units.

Cathodes are charged into the two furnaces continuously from special charging machines at such a rate as to displace molten metal at the desired casting speed. Molten metal tapped from the two cathode melting furnaces flows into a launder system so arranged as to permit use of one or the other, or both, casting wheels. A short discharge launder in the center of the X-shaped launder layout is used for withdrawing molten copper for making molds.

Wire Bar Wheel

Anode scrap not being uniform in size and shape is fed into the furnace feed chute by hand, one piece at a time, from an elevated platform. The two wire-bar casting wheels are each equipped with 19 molds, and the anode casting wheel with 12 anode molds. Casting of wire bars is continuous, with the filled mold previously sprayed with bone ash being dumped into a bosh filled with water, followed by automatic righting, hand spraying, and refilling.

Cooled bars are transported by an endless bar conveyor to a second conveyor for inspection. All openings on the electric furnaces are provided with hoods on forced draft to avoid discharge of copper dust within the casting house. The dust is directed to a wet collecting system. The casting house also contains cathode shears, cold saw, wire bar scalping machine, shape sampling section, compressor room, office, and shower and locker rooms. Refined copper products produced and shipped include wire bars,



CATHODES ARE MELTED in two 15-ft. Type "M" Lectromelt furnaces. A third furnace melts anode scrap. Walker wheel in foreground is one of two 40-ft. wheels casting shapes. Furnaces use 14-in. graphite electrodes.

ingots, ingot bars, and sheared cathodes.

The three-story building housing the anode slime treatment plant adjoins the electrolyte purification plant on the south. Anode slimes produced in the tank house are pumped as slurry to two settling tanks on the third floor of the building. Solution decanted from these tanks is first passed through a large secondary settling tank and then through a rubber plate-and-frame filter press equipped with paper filter medium supported on stainless-steel screens. Clarified solution is returned to the tank house.

Anode Slime Treatment

Thickened slimes from the settling tanks are mixed with decopperized electrolyte, heated with steam, and agitated with air in Pachuca-type agitators. The pulp is then filtered in a small lead drum-type filter, with the filtrate being returned to the electrolyte purification plant.

The cake from the filter is fused with sodium bisulphate to convert all of the copper to sulphate and to expel all of the selenium contained, mainly as selenium dioxide. The selenium product is caught in a series of spray towers, followed by Cottrell precipitators, and the solution is treated for recovery of selenium.

The fused mixture of slimes and sodium bisulphate is granulated and leached with water and filtered on a plate-and-frame filter. Any silver in solution is cemented out on copper, and copper-bearing solutions are returned to the electrolyte purification plant.

Solids from the filtration are leached with caustic soda solution to dissolve tellurium and some lead, followed by filtering in another plate-and-frame filter. Filtrate is treated for tellurium recovery, and the cake, together with the cemented out silver mentioned before, is melted in a small reverberatory Doré furnace. Base metal impurities are oxidized and collected as a soda slag.

The Doré metal is cast into anodes for electrolytic parting in Moebius cells. Collected gold slimes are boiled with sulphuric acid to dissolve any remaining silver, then melted in a graphite crucible, and cast into gold anodes for electrolytic refining by the Wohlwill process.

Small amounts of platinum and palladium are recovered from the gold chloride electrolyte. Gold cathodes are melted and cast into bars, and the silver crystals from the Moebius cells are melted in graphite retort furnaces and cast into 1,000 to 1,200-oz. bars.

Boiler House

Equipment available in the boiler house for heating electrolyte and plant buildings consists of two stoker-fired boilers operating at 30- to 40-lb. pressure, each capable of producing some 40,000 lb. of steam per hr. Water used in the boilers receives previous treatment in an extensive water softening and treatment plant at the head of the boiler house.

Auxiliary plant units include a well-equipped maintenance shop, carpenter shop, warehouse, administration building, cooling tower and settling ponds for bosh water, outdoor substation, laboratory, and garage. On the east side of the casting house is a large paved area for storing wire bars and ingots. It is served by a overhead crane operating on a 97-ft. crane

WIRE BARS come off end of conveyor, following inspection for flaws, and are stacked on pallets for truck haulage to freight cars (See front cover).

bay. A similar storage yard for cathodes and anode scrap is situated between the tank house and the casting building.

Power Supply

Power for the refinery is supplied from the company's central power station above the Magna concentrator at 44,000 v. over a two-circuit steel tower transmission line. At the refinery this voltage is stepped down to 13,800 v. in an outdoor substation containing three 7,500/9,375-kva., 3-phase, 60-cycle transformers, together with necessary switch gear.

Low-voltage alternating current to the different auxiliaries is taken from four 1,500-kva., 13,800/460-v. double-ended unit substations situated as close as possible to the center of loading. The air circuit breakers in this metal-clad gear act as back-up breakers for 14 motor starting load centers placed at center of loading. All motors are started at full voltage.

The pushbutton station are generally at the equipment to be controlled, and in certain locations where wet processing takes place control transformers from 440 to 110 v. are used for the pushbutton circuit as a safety measure.

Primary distribution is at 13.8 kv. by single conductor, rubber-insulated, neoprene-jacketed cables supported in composition cable cleats attached to angle-iron supports. Multiple cable units are carried through concrete tunnels, and single cables are run in non-metallic conduits enclosed in a concrete envelope. High-voltage cables are terminated in the open rather than by means of pot heads. Properly grounded stress cones are provided at each termination.

A 13.8-kv., metal-clad, truck-type, draw-out switch gear provides switching and protection for all 13.8-kv. feeders, and also for the motor-generator sets. Control of this switch gear is from a tunnel-type duplex board situated at one end of the main motor-generator room. On this board are also control units of oil circuit breakers. Operating energy for all circuit breakers is furnished from a 60-cell, trickle-charged battery.

All buildings are of concrete and steel-frame construction with brick curtain walls and precast concrete slab roofs with asphalt felt covering. The roof of the tank house is insulated.

To make working conditions within the buildings as safe and pleasant as possible, special attention was given to lighting, ventilation, and safety first. All buildings are provided with ample windows, efficient artificial lighting systems, mechanical ventilation where required, and many automatic control units. These have played a considerable part in the smooth breaking in of the plant with labor and supervisory personnel inexperienced in refinery work. Only 15 men with previous refinery experience were available at the start of operations, and these have formed a fine nucleus for operating supervision.

Save for the administration building and chemical laboratory, all buildings are lighted by high-bay units, using either 1,000 or 1,500-w. incandescent lamps. Exceptions are lighted with 96-in. slim-line fluorescent lamps enclosed in 4-lamp fixtures. Two-way switching is provided in order to control intensity. Power for lighting is furnished by dry-type transformers generally mounted on steel platforms above the bottom chord of the roof trusses. All high-bay units are controlled in rows or groups from pushbuttons on the building columns. Each button controls a combination line starter connected to the 440-v. side.

Materials Handling Equipment

Equipment units in the different buildings are so spaced and installed as to afford quick and easy access for repair and adjustment, and mechanical handling of materials is provided by the generous use of overhead cranes and mobile lift and transportation units. For instance, cathodes and anode scrap are carried from the tank house to the casting house in trains made up of rubber-tired, four-wheel, steered trailers drawn by rubber-tired, battery-powered tractors.

For handling anodes, cathodes, wire bars, and other refined shapes, machinery, and other materials, there are available throughout the refinery 12 overhead cranes, three tractors, three 4-ton fork trucks, and three 2½-ton fork trucks. Tractors and trucks are battery operated. Cranes are operated on direct current furnished by three 300-kw., 250-v., sealed-type ignitrons operating in parallel on a common bus. Power to each crane is controlled by individual air circuit breakers in metalclad gear.

UNPARALLELED POSITION of the Western Hemisphere is indicated in the table on page 82. This area has the world's principal supplies of antimony, asbestos, barite, bauxite, beryl, cadmium, copper, coal, fluorspar, iron, lead, molybdenum, nickel, petroleum, phosphates, silver, sulphur, high-grade tantalite, vanadium, and zinc, as well as important sources of cobalt, diamonds, graphite, kyanite, manganese, mercury, mica, platinum, potash, tin, titanium, tungsten, uranium, and low-grade chromite.

To these impressive mineral advantages it can add the greatest industrial powerhouse on earth, an unequalled pool of technology and skill, and the "moat" provided by oceanic and arctic barriers. True, these barriers can be hurdled by an air force, which, armed with modern weapons, can inflict immense damage. However, they cannot be passed over by the large forces necessary for successful invasion unless the enemy dominates both sea and air or resistance collapses from within. Considering the management problems which a tyrannical regime would have with the rest of the world before undertaking such an adventure, the conclusion seems valid that the Western Hemisphere may be isolated and crippled, but not taken, except from within.

Victory or Stalemate?

Mineral resources of either the Western Hemisphere or the Soviet sphere are adequate for a resolute defense. The Communists would have to acquire most of the resources of the rest of the world in order to "pack a knockout punch."

EVAN JUST
Editor

WE CANNOT BE SURE of winning a war, if one should break out between the communist and free worlds, simply because the communists would lack the minerals to buttress their defensive efforts. Even though denied mineral supplies from most of the outside world, with the kind of determination and sacrifice that held Hitler at Stalingrad, they could probably produce a stalemate.

On the other hand, if the Soviets should dominate all the rest of the world outside the Western Hemisphere, they could not thus deny us the minerals necessary for our defense if we show the same kind of determined resistance and do not gamble with our security by failing to take precautionary steps.

The importance of the mineral supplies available in the areas outside the Soviet sphere and the Western Hemisphere is that, without a large share of them, for at least 10 and probably 20 years the Soviet sphere would probably lack the ability to wage offensive war with a reasonable hope of success against the Western Hemisphere, if the latter chooses to resist. Thus, as long as Soviet aims are belligerent, it is fundamental to our defense to try to deny them control of the resources necessary for successful offensive warfare.

We know that successful modern war-making cannot be accomplished without mineral raw materials. Everybody realizes the enormous advantages of superior equipment in war-making. The way the United Nations forces have chopped comparatively poorly armed Chinese hordes to pieces in Korea indicates the frightful sacrifices of human life and well-being that it takes to oppose a mechanically superior foe. Recalling the experiences of two world wars, it is generally realized that the industrial output of the United States was a decisive factor in determining the outcomes. And we know that industrial output of modern war materiel requires a great variety of mineral raw materials.

Our pattern has been to throw resources at the enemy pell-mell. Lacking resources in abundance, the Russians in World War II and the Chinese communists in Korea threw bodies and lives into the breach, and even shot their own soldiers who wrecked equipment accidentally. The adversary which is able to

. . . FIGHTS EAST

ALTHOUGH HANDICAPPED in comparison to the Western Hemisphere, at least insofar as production and known reserves are concerned, the Soviet sphere does not lack the resources necessary to sustain a going economy or to support a last-ditch defense. It is well supplied with antimony, asbestos, beryl, chromite, manganese, nickel, phosphates, platinum, potash, tungsten, and probably bauxite. To increase its iron ore production calls for the use of low-grade, poorly-located ores. It produces petroleum, copper, lead, zinc, and several other important minerals, but its self-sufficiency in them is doubtful, and almost certainly inadequate if weighed against similar concepts of need to those used by our own military planners. However, any such large and relatively undeveloped portion of the earth's continental areas must have important mineral potentialities.

The immense size and large population of the Soviet Union make it infeasible for any outside powers to undertake conquest or the policing job that conquest would subsequently require. Offensive action must necessarily be confined to raids and containment rather than an invasion which would eventually swallow up or ruin the invader.

Minerals Can Decide[1]

waste resources can save lives and limbs wholesale, can overcome manpower handicaps, and can release manpower from a desperate effort to produce raw materials from marginal sources. In short, we cannot afford to take the risks we took prior to both world wars by being grossly unprepared in terms of mineral raw materials.

It is very difficult to state quantitatively just what amounts of minerals are necessary to successful war-making. In World War II the Axis powers made remarkable headway temporarily despite apparently overwhelming disadvantages in regard to petroleum, copper, manganese, chromite, diamonds, nickel, tungsten, tin, and several other minerals. If this temporary success had given them access to more raw materials, the war would probably have been greatly prolonged, if not stalemated. In many instances, mineral deficiency means, not an absolute lack of tools or war materiel, but simply an inferior position which can be offset by wasteful use of manpower, sacrifice of men in battle, discomfort of civilians, strong determination, and leadership. At the present time there is a great deal of poppycock in circulation to the effect that the loss of certain resources, such as Far Eastern tin, would jeopardize Western security.

Taking manganese as an example, there can be no doubt that access to India and Africa are advantageous. Nevertheless, if we were restricted to the Western Hemisphere, adequate manganese supplies are obtainable through development of Brazilian deposits, of low-grade deposits in North America and by reclamation of manganese from slags. As a matter of fact, if we are not foolish enough to be caught napping, self-sufficiency can be attained within the United States alone at the price of developing very low-grade deposits and building slag-treatment plants. Moreover, no doubt the use of manganese is susceptible to economies, if not dispensable entirely, through research into alternative methods of "doctoring" steel.

Peculiar Advantages

Apart from the problem of industrial capacity and the raw materials necessary to make that capacity effective, each side to the current controversy has certain peculiar advantages inherent in the system it espouses. Being a dictatorship, the Kremlin hierarchy has more ability to direct national resources and energies to specific ends than is the case in governments which depend essentially on popular consent. Also, the communists have proved themselves to be masters of subversion, propaganda, and infiltration. Democratic communities and processes are particularly susceptible to these forms of penetration, while a police state is least susceptible.

On the other hand it is impossible for a forced-labor system to attain the productivity per citizen that is so conspicuously a part of

[1] Adapted from a paper given at the Annual Meeting, American Institute of Mining and Metallurgical Engineers, Feb. 19, 1951, "Principal Mineral Strategic Problems in a Conflict between East and West."

Mineral Positions of Various Areas

(EXPRESSED AS PERCENTAGES OF WORLD TOTAL)

	Western Hemisphere	Australia, etc.	Western European Fringe and Southern Africa	Middle Western Europe, etc.	Near East	Far East	Soviet Sphere
Antimony	50	2	13	9		1	25
Asbestos	60		15	4		1	20
Bauxite	60		6	8		8	18
Beryl	55	2	10			3	30
Chromite	5	3	34	24		14	20
Cobalt	10	3	80	4			?
Columbite (h.g.)			99				?
Colum-Tanta			90	5			?
Copper	62	1	20	6		2	9
Diamonds	5		95				
Fluorspar	50	2	20	13		3	?
Iron Ore	45		10	20		5	20
Lead	50	18	10	13		1	8
Manganese	9		21	7	3	15	45
Mercury	16		32	40		5	?
Molybdenum	88			2			10
Nickel	80	3					17
Petroleum	66		1	1	16	2	14
Phosphates	40	3	1	25		1	30
Potash	25		5	40			30
Steel	47	1	11	20		3	18
Tantalite (h.g.)	75						?
Tin	20	1	15			58	6
Tungsten	21	5	22	3		12	37
Vanadium	78		13	?		?	?
Zinc	56	11	6	14		1	12

Data mainly from U. S. Bureau of Mines "Minerals Yearbook," adjusted in some cases where reserves are out of balance with current production. Reference was also made to "Mineral Resources of the Free," by Allan F. Mathews, published in "Freedom and Union," October, 1950, and to "Russia's Mineral Potential," by Paul Tyler (A.I.M.E.).

our economy. Also, even though the people of the democracies may appear to be somewhat less than devoted to their ideals, there can be little doubt that in a last-ditch ideological struggle, people will fight harder to be free than for any system of slavery. However, there is a factor that conditions the will to resist more than any ideological concept. Both the British and the Russians in World War II proved that the resistance of a people can become phenomenal when defending their homeland against invasion. It is the extra impetus given to a national war effort under such conditions that creates the doubt that either the Soviets or ourselves can be completely conquered, or successfully dominated after conquest.

Intervening Areas

The areas outside the Western Hemisphere and the Soviet sphere compose approximately half the land area of the globe. These areas have great mineral resources, immense populations, large production facilities, and valuable industrial know-how. The most strategic of them cannot be expected to remain neutral in a conflict between the Soviets and the Western Hemisphere. How much can we afford to leave to chance their adherence to one side or the other, knowing that such adherence would be a tremendous advantage to the favored adversary?

This question cannot be answered in a simple statement. It is improbable that the entire intervening area would adhere to one side exclusively. Also it seems improbable that some regions, notably the Far East, could completely avoid trading with both sides, even if the political leaders would choose to favor one adversary. To answer the question requires an analysis of what parts of the intervening area are likely to behave as units and of the strategic significance of the various units. They

(*Continued on page 84*)

Five Chips

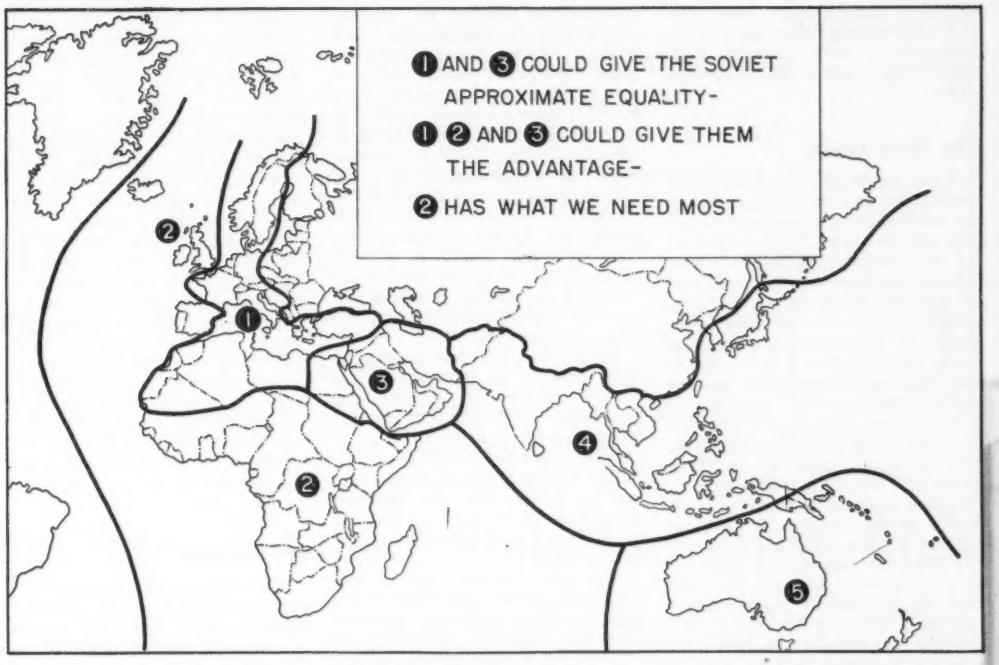
1 A BLUE CHIP in the international poker game, Middle Western Europe, French North Africa, and Turkey have large supplies of iron ore, coking coal, potash, zinc, lead, bauxite, mercury, chromite, manganese, cobalt, antimony, asbestos, and copper. In all of them, except copper, manganese, asbestos, and cobalt, the area is approximately self-sufficient. To these basic resources it adds a numerous, highly-trained, capable manpower, and important smelting, refining, fabricating, and manufacturing facilities. Its control would eliminate Soviet deficiencies in technology, skilled workers, steel capacity, iron, coal, zinc, lead, mercury, petroleum refining, metal smelting and refining, and general industrial capacity. With it would go partial control of the Mediterranean, the Soviet's present lack of access to warm-water ocean ports, and valuable bases for attacking the Western Hemisphere. Its adherence to the free world would put the Soviet sphere at a serious handicap in technology, skill, iron, steel, aluminum, smelting, refining, industrial capacity, access to the Atlantic, and possibly in mercury, copper, lead, zinc, and fluorspar.

The Scandinavian Peninsula deserves special study as to its defensibility. It possesses key iron resources, aluminum and zinc smelting, much of the area's copper, timber, power, a capable, freedom-loving people, and valuable potential air bases.

2 MOST VITAL to the Western Hemisphere, Southern Africa supports the world's largest chromite and uranium production, is the heartland of diamonds, cobalt, tantalite and columbite, and has important manganese, tin, copper, asbestos, platinum, kyanite, lead-zinc, fluorspar, coal, antimony, beryl, flake graphite, and mica deposits.

In the non-mineral field it has not only a considerable production of rubber and fibers, but areas where the production of such crops can be greatly expanded in case of need. Also being industrially undeveloped, its affiliation involves no great burden of supply from the Western Hemisphere. However, this latter advantage is more or less offset by the dependence of the European mother countries—to which it would tend to adhere—on the outside for food and raw materials. On the resource side, these European countries contribute lead, mercury, zinc, tin, sulphur, barite, fluorspar, coal and iron ore, but as a group, only mercury in exportable quantities. In addition, they have vitally important sea and air power, capable, well-trained people, important industrial capacity, strategic harbors and air bases, and control of the Mediterranean's entrance.

in International Poker



3 OIL BARREL for Europe—the Near East's only important strategic known mineral resource is petroleum. It also has valuable refining capacity, but not enough for its crude oil output. Limited quantities of manganese sulphur and other minerals are also known to exist.

The petroleum resources are of great strategic importance primarily because of Europe's dependence on them. Also, they would be very helpful toward successful war-making by the Soviet sphere, which may have important reserves of petroleum but lacks development and refining capacity.

This area is considered a unit because of its common religious and racial conditions, and because it lacks important sympathies with either the Western or Soviet spheres.

Because of its position, it would be difficult to defend against a determined offensive by the USSR, which, however, would have to attack over difficult terrain or by air. If it is deemed not defensible, attention should be given to providing a fleet of tankers to supply our European allies from the Western Hemisphere. It it is considered defensible, stronger measures than now appear to be in the making should be taken to protect the Near East against invasion from the north.

4 NOT VITAL and replete with liabilities, the Far East's principal mineral resources are tin, manganese, mica, iron ore, coal, bauxite, petroleum, chrome, titanium, kyanite, fluorspar, graphite, copper, mercury, lead, zinc, monazite, cobalt (undeveloped) and nickel (undeveloped). Of these, tin, manganese, and mica are the most strategic, although exportable surpluses exist of titanium, bauxite, chromite, kyanite, and monazite. Important non-mineral strategic resources are: very abundant manpower, steel capacity, rubber, fibers, and pepper.

This area is the world heartland of tin, accounting for 58% of the world's production and at least this fraction of reserves. Were it segregated from the Western world, the latter would be cramped for tin.

On the other hand, for the Far East area to deny tin or rubber to the Western world would involve considerable internal hardship in terms of what it obtains through exports of these raw materials. Probably a complete embargo could not—or would not—be maintained with reference to either the Western or Soviet sphere.

The Far East will be a "management headache" to any power seeking to dominate it and a serious drain on the resources of any powers which undertake to assure its defense.

5 LOYALTY AND GEOGRAPHY call for full support of Australia, New Zealand and New Caledonia in their defense against any aggression in the future.

Because of its traditions and geographic position, Australia can be expected to adhere to the Western World unless forced to do otherwise, and could reasonably be expected to be the last area outside the Western Hemisphere to submit to Soviet expansionism.

With this area would go important lead and zinc production and less important nickel, copper, chromite, tin, zircon, and uranium. All of these resources except chromite and tin would be very beneficial to the Soviet sphere, particularly if it should by then have incorporated the consuming needs of Asia and Europe. The nickel deposits, although low grade, are very extensive, and could be equipped to support a much larger share of world production than they now account for.

This area in hands loyal to the free world would also be a continued threat to Soviet control of the East Indies and southeast Asia, particularly realizing that the people of these areas would no doubt be quickly disillusioned at communism's inevitable failure to fulfill its glittering promises to the impoverished masses.

differ tremendously as to their resources, their populations, their industrial capacities, their loyalties, and their defensibility. Their relative statuses when these factors are balanced to make some of them "blue chips" and some of less net value.

The Blue Chips

From a resource standpoint, it is evident that the "blue chips" outside the Western Hemisphere and the Soviet sphere are in Africa and Middle Western Europe. Both of these areas have very important mineral production. Although it would be difficult to rate one of these areas ahead of the other on a mineral basis, the resources most needed in the Western Hemisphere are in Africa, whereas the minerals of Europe are essentially complementary to its own industrialization, skill and potential military power. When this difference is weighed against relative defensibility, Africa emerges as the most vital of all the areas mentioned to the Western Hemisphere. Against this argument, it might be said that the defense of Europe automatically defends Africa, but the defense of Europe is tied up with several important factors, including the determination of its inhabitants to resist aggression and the actual armament available in the field. Southern Africa, on the other hand, seems defensible by forces supplied mainly from the Western Hemisphere.

The adherence of the Western European fringe and Southern Africa to the free world would assure the latter of access to the world's principal supplies of diamonds, cobalt, mercury, tantalite, columbite, flake graphite, and uranium, and important sources of manganese, tin, chromite, asbestos, and antimony. It would place the Soviet sphere in serious difficulty for diamonds, and possibly copper, tantalite, columbite, cobalt, and uranium, even though the Far East, the Near East, and Middle Western Europe were won by the communists.

On the other hand, the loss of all these areas by the Western World would place it in difficulty in regard to tin, diamonds, manganese, chromite, cobalt, tantalite, columbite, possibly also graphite, mercury and strategic mica.

To assure the accessibility of Southern Africa to the free world in case of war involves several precautions. The production facilities should be put in good shape as to capacity, modernization, and sabotage prevention, and undeveloped potentialities should be realized, particularly in manganese. Railroads should be standardized as to gage, modernized as to rights of way, and fully equipped with rolling stock. Important areas possessing only single outlets should have alternative routes. Harbor facilities should be brought up to emergency requirements. Steps should be taken to assure well-being and order among the native African population. Finally, complete military plans should be made for the determined defense of Southern Africa, the United Kingdom, and the Iberian Peninsula.

From the mineral standpoint, quite clearly the Middle East is third in importance. Its petroleum is valuable to European well-being and would be of great value to an enemy. However, its oil is not required by the Western Hemisphere and its divided loyalties, unskilled population, primitive economy, and geographical position all hinder its defensibility.

This leaves the Far East and Australia as the less vital of the intermediate areas, although both of them have valuable exportable mineral surpluses. The defense of the former, however, involves several major problems, including its size and proximity to the Soviet sphere, its divided loyalties, and immense supply needs. Also, like Europe, no arrangement can be made for its successful defense which can be anything but tributary to its own armament and will to resist. In the Australian area, on the other hand, the desirability of planning definitely to commit ourselves to its defense is buttressed by its geographical position and determination to resist communism.

Certain minerals, because of their relative importance and because of relative scarcity in the Western Hemisphere, deserve special attention in the way of accelerated stockpiling efforts and extraordinary action to strengthen productivity in defensible areas. In this list are tin, manganese, chromite, industrial diamonds, cobalt, columbite, tantalite, flake graphite, and possibly tungsten, antimony, mercury, and kyanite.

Defense Not Enough

In demonstrating the advantageous mineral position of the Western Hemisphere, there is no intention of conveying the impression that war can be won by defensive tactics alone or by reducing defensive measures only to the stategically most important areas. The most dynamic human developments in the twentieth century are not communism, terrorism, or dictatorship. They are individual freedom, democracy, and the incentive-stimulated industrial system which America typifies. To contain these forces behind a Maginot Line in a contest which is essentially for men's minds and in which, under the opposition, poisons these minds into violence and unwarranted hatred, seems like a poor way to employ our inherent advantages. In the dynamic style which our traditions dictate, we should be out campaigning for the adherence of every individual who aspires to be free, and penetrating behind the Iron Curtain for the support of those subjugated millions who have already discovered what a hollow mockery are the pretensions of the Soviets in behalf of the common man.

No Retreat

To retreat either physically or philosophically to the Western Hemisphere would not only abandon hundreds of millions of people to a miserable fate and grant the enemy an opportunity to assume the offensive in case of war, but would ignore the fact that even the stagnation consequent upon a stalemate is a comparative advantage to the communists. They capitalize on misery and discord, whereas our way of life thrives only in an atmosphere of economic growth.

Also, it is absurd to consider our present status as a peaceful one, when the Soviets actually declared war on us thirty years ago and have been waging it ever since. The communist parties scattered throughout the free world, and their activities, are clear evidence of this long-standing aggressiveness. There is no confusion in the enemy's mind as to the identity of his antagonist, or lack of determination to make war and win at a time of his own choosing. We cannot consider ourselves reasonably secure until we drop a "business as usual" attitude and really get to work on the precautions indicated above. All the numerous advantages which we enjoy can be dissipated by indifference and indecision. The artifices of diplomacy nothwithstanding, war has been declared upon us. We can ignore this only at our peril.

Figure 1—Timber Prices

(Standard timber prices like these are posted each week. See page 86 for explanation of units.)

Period from November 27 to December 9, 1950
(Per unit of timber installed)

PLACE	PRICE
Repair	.05
L. C. South Drift	.045
171 Stope	.05
172 Stope	.05
174 Stope	.05
174 Raise	.055
176 Stope	045
177 Raise	.05
178 Raise	.045
259 Raise	.05
264 Drift	.05
350 South Drift	.055
357 Stope	.06

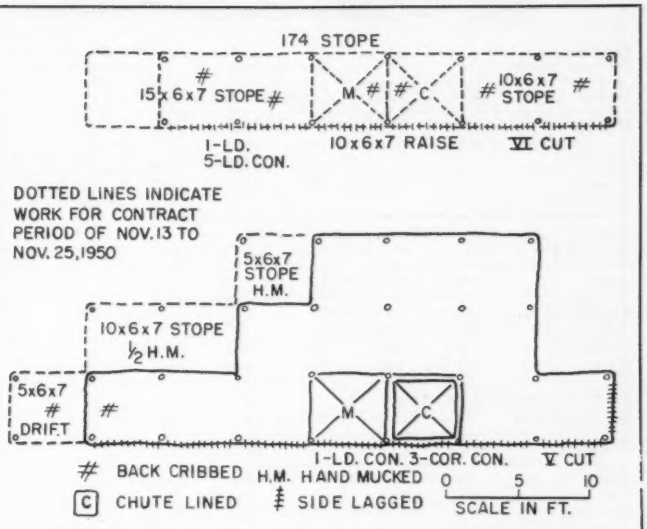


Figure 2, at right, shows how engineers record stope progress on standard cross-section field sheets.

Successful Small-Mine Incentive Plan

J. E. DUNN

Callahan Zinc-Lead Co., Inc.
Akron Mine, Sargents, Colo.

THIS INCENTIVE PAY or piece-work contract system was first adopted by Callahan Zinc-Lead Co. at its Deadwood Unit in central Idaho in 1944. It was in use there for two years and has been in use since at the Akron Unit at Whitepine, Colo.

Day's-pay work underground was not satisfactory as other operations in that area were starting some contract work, which made it difficult to keep the better type of miner. Other types of work were also attractive to miners at the time. Hence another objective was to make mining more attractive.

The first contracts attempted at Deadwood were payment by the foot on development and by the set on stoping. These were not satisfactory because of variation in ground conditions and different types of timber necessary in different stopes.

The piece-work system finally adopted is closely patterned after that used in the Butte district for some years. The purpose was to set up contract items on a sliding scale to cover all underground work regardless of type of timber in use or working conditions in various headings. Many changes were made during the first year. Since then, adjustments have been minor and the system put in use at Akron in 1946 remains practically unchanged.

The versatility of the application is almost unlimited as we are using practically every method of stoping with the exception of block caving. Vein dips vary from 30° to vertical. Ground varies from that which requires no support to areas where top slicing is required.

Prices contained herein are not applicable to all mining and would vary a great deal in different locations and under different conditions.

Service to working place has a very definite effect on timber price. Working conditions in general and character of the ground affect all prices. In calculating prices to fit a different operation, past costs must be taken into consideration and used as a basis to set unit prices.

Fig. 3 shows standard breaking and miscellaneous timber prices. It also shows unit value of various types of timber, mucking, slushing and tramming prices. Prices on this sheet are standard and are seldom changed. A copy of this sheet is posted in the change room. Prices paid per timber unit may vary in different parts of the mine and may also be changed from time to time. For instance, after a raise is up 50 ft. above the sill, timber prices may be raised for the remainder of the distance to the level above. Fig. 1 shows standard timber prices that are posted every two weeks. These prices apply to units of timber installed during a contract period. Only timber in place is paid for. Timber that has been blasted out accidentally must be replaced by the contract crew.

Contracts are measured and calculated by the engineering department every two weeks.

Underground mapping is done on a 1 in. = 10 ft. scale on standard field sheets. (Fig. 2.) This sheet shows timber in place and excavation in a standard cut and fill square set stope which will be followed through until final settlement. Miscellaneous timber items such as booms that have been removed and cribbing in place that cannot be seen are taken from the miscellaneous record which is turned in on daily time cards with approval of shift foreman. Fig. 4 shows the miscellaneous record sheet for the contract as illustrated in Fig. 2. Fig. 5 shows a contract calculation sheet on which information on work accomplished from field sheets and miscellaneous record has been entered, priced and extended. The crew's names and hours worked are entered by the accounting department and the calculation carried through to the final result.

Figure 3—Callahan Zinc-Lead Co.—Akron Unit—Contract Prices

Note: The following contract rates are included only to illustrate how details of the incentive system are worked out, and are not necessarily those in effect today.

STOPES

Breaking Prices — Timber Units — Extra Breaking

Width	Price	Post	Ld.Con.	Cor.Con.	Ld.
6′ & over	.045	5′	160	80	290
5′	.05	5½′	170	100	310
4′	.07	6′	180	110	330
3′	.09	Over 6′	190	120	350
2′	.11				

Moil, Pick and Strip will be paid 1½ times the breaking price.

KEY TO ABBREVIATIONS

HM—Hand mucked.
Ld. Con.—Lead connecting set—2 posts, 1 cap, 2 girts.
Cor. Con.—Corner connecting set—1 post, 1 cap, 1 girt.
Ld.—4 post lead—4 posts, 2 caps, 2 girts.

RAISES

Breaking Prices — 10 x 10 Timber — 12 x 12

Section	Price	Ld.Con.	Ld.	Ld.Con.	Ld.
4½ x 8½	.10	(Crib 4 x 8)			
5 x 9	.095	(Heavier crib)			
6 x 12	.09	180	330	270	400
6 x 18	.08	180	330	270	400

Moil, Pick and Strip will be paid 1½ times the regular breaking price.

Units given for Raise Cribbing:

4″ x 8″ 1 x w x h x 2

8″ x 8″ 1 x w x h x 3

DRIFTS AND CROSSCUTS

Breaking Prices — Timber Units

Section	Price	Cap	Post	Ld.Con.	Ld.
4 x 6	.16	5′	6′	160	290
5 x 7	.115	5½′	6′	170	310
6½ x 7½	.09	5½′	6½′	180	330
7 x 8½	.08	5½′	7½′	190	350
8 x 8	.07	5½′	8′	190	350
8 x 9	.06	6′	8′	200	370
9 x 9	.06	7′	8′	210	390
Over	.05	8′	8′	220	410
		9′	8′	230	430
		10′	8′	250	450

Moil, Pick and Strip at 1½ times the regular breaking price.
Add 25 units to Ld.Con. for 12″ x 12″ Caps.
Add 50 units to Ld.Con. for 12″ x 12″ Caps.

EXTRA TIMBER IN UNITS

Booms, butt caps, stringers receive five units per foot of length—5 units/ft. Cap replaced—125 units.
Post replaced—100 units. Spiling—1 x w x 3. Sills—7 units/ft. length. Breast Board—1 x w x 3.

MISCELLANEOUS ITEMS

Item	Price	Unit	Remarks
Blocks (Squeeze)	.35	ea.	8 x 8 or over
Box-headings	1.10	ea.	At least 8″
Braces, extra	.50	ea.	
Bridges	1.10	ea.	
Bulkheads, single	.90	ea.	No pay for blkhds.
Bulkheads, double	1.35	ea.	taken out.
Chute Lining, 4″	1.60	side	With one extra
Chute Lining, 3″	1.35	side	brace on each
Chute Lining, 2″	1.00	side	side.
Chute Lip, perm.	17.50	ea.	
Chute Lip, temp.	5.00	ea.	
Cribbing	.04	cu.ft.	1 x w x h
Ditch (no box)	.18	per ft.	5″ x 5″, if smaller,
Ditch (boxed)	.35	per ft.	.10 per ft.
False Sets	2.50	ea.	
Fan Bag	.02	per ft.	
Fan Installed	2.50	ea.	
Flooring, Slusher	1.25	set	no pay out
Flooring, Slide	1.35	set	no pay out
Girts	1.25	ea.	extra 8 x 8, over
Girts	.75	ea.	under 8 x 8
Gob Lagging	1.10	side	
Guides Installed	.08	ft.	new manway
Grizzley	2.50	ea.	60-lb. rail
Holes, test	.75	ea.	Drift Leyner
Holes, test	1.00	ea.	Hand-held Machine
Ladders	.08	ft.	Repair Manway only
(New Manway Ladders included in timber units for Raising)			
Lagging, 4″	1.50	side	special
Pipe, ½″	.08	ft.	not in regular heading
Pipe, 1″	.08	ft.	not in regular heading
Pipe, 2″	.10	ft.	not in regular heading
Post, angle	2.50	ea.	
Slides, timber	.15	ft.	
Slusher & Bucket, moved up or down	No. of hours must be checked by shift foreman & marked on time cards.		
Stulls over 5′	1.50	ea.	
Stulls under 5′	.90	ea.	
Switch, tongue	7.00	ea.	12-lb. rail
Switch, tongue	11.00	ea.	20-lb. rail
Switch, throw	12.00	ea.	12-lb. rail
Switch, throw	15.00	ea.	20-lb. rail
Spreaders	.65	ea.	
Track Replaced	.25	ft.	12-lb. rail
Track Replaced	.35	ft.	20-lb. rail
Umbrella Sets	2.50	ea.	

MUCK AND ORE TRAMMING PRICES

0 – 50′ will be at .0075, add .0035 for each 50′ thereafter.

MUCKING PRICES

Ore mucking .06 Machine mucking on main level .025
Waste mucking .05 Machine mucking on sub level .035

SLUSHING PRICES

Stope .015 to chute — .025 to cars — Fill .02 Drift .025 to chute — .035 to cars

There will be special breaking prices for bad ground. The breaking price for stations is .055 unless otherwise stated. All company time is to be checked by the shift foreman and taken only with his approval.

which is hourly rate of pay. Differentiation between contract work and company time is made by the use of different colored time cards.

This sheet is checked for errors and is approved by the superintendent, after which it is posted in the change room for 24 hours. During this time the contract is open for negotiation and any errors or differences with the contract crew are settled. Nearly all settlements are negotiated by the measuring engineer. Settlements that cannot be agreed upon are arbitrated by the superintendent, who also approves any price changes or adjustments.

The settled contracts then go to the accounting department and are entered on the time sheets at their respective rates.

Contracts on drifting and raising are handled in the same manner, with the exception that they are paid on standard cross sections with no pay for over-break. Mucking and tramming are paid on over-break, as is cribbing to fill the opening. Cribbed raises are handled by a slightly different method. Timber units are calculated as shown under "Units given for raise cribbing" on Fig. 3.

There are several disadvantages in handling this method of incentive pay, chief of which are as follows:

1. Administration must be handled carefully. Individuals must feel that they are free to bring in grievances regarding their contract at any time.

2. Practically every man on the crew may have a different rate, which, of course, is added payroll work.

3. With a small crew of 10 to 20 contracts in force, it requires two to three days' work for an engineer each contract period.

4. High hourly rates on contract crews are a source of dissatisfaction for men not on contract, such as mill and shop crews.

Advantages far out-number inconveniences:

1. Production per manshift increases materially over day's-pay work.

2. The better class of skilled underground labor is attracted.

3. With this type of labor, less supervision is required.

4. Crew is better satisfied with greater take-home pay, has more interest in accomplishing a maximum turnout per shift and, in general, works more steadily.

5. Underground costs are lower.

MISCELLANEOUS RECORD

DATE		BLOCKS	SPILING	SIDES CHUTE	SIDES GOB	CRIBBING	SHORT STULLS	LONG STULLS	BOOMS	SILLS	FALSE SET	STAND SETS	POSTS	CAPS	GIRTS	MUCK	TEST HOLES	CO. TIME	OTHER
1	14					5x5x1 out										1 round H.M.			2 spreaders
2	17	2				5x5x1 in						ld.			2				2 Bulkheads
3	18					5x5x2 in						ld. con.			2				1 muck slide
4	19																		
5	20	2										ld. con.			2				1 spreader
6	21			4	4	5x5x2 in									2	½ round H.M.			1 spreader
7	22					5x5x1 in						ld. con.			2				
8	25	2										ld. con.							1 spreader
9	26	2			4	5x5x1 in									2	½ round H.M.		4 hrs	on changing slusher
10	27					5x5x3 in						ld. con.			2				1 spreader
11	28																		
12	27																		
13	28	2				2½x5x8 out				2-5'		ld. con.			2				3 slusher floors
14	29				4	5x5x2 in				2-5'		car. con.			2				4 spreaders
15	30	2			2	2½x5x8 out						2 car. con.			2				3 slusher floors
	31																		

PLACE 174 STOPE PERIOD 11/13 - 11/25 1950

Figure 4. Miscellaneous items, not included in the standard field sheets, are noted on a miscellaneous record to be used in contract calculations.

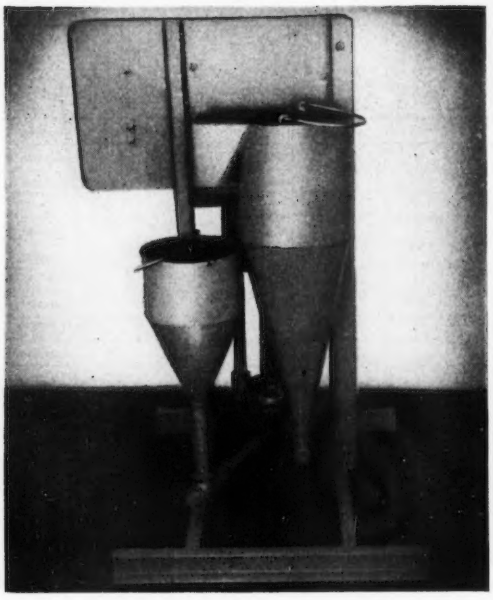
CONTRACT CALCULATIONS

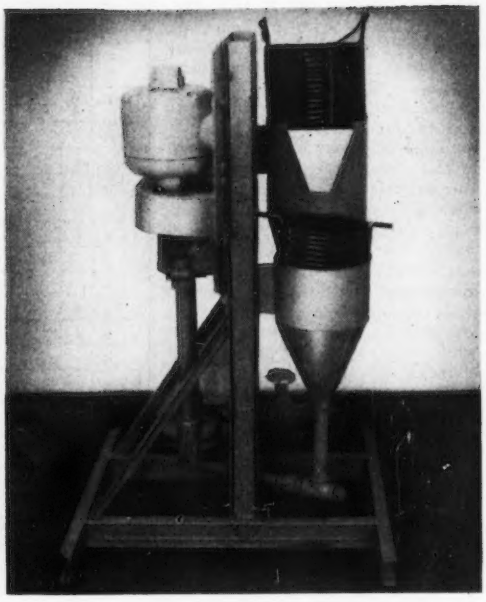
PLACE 174 Stope PERIOD 11/13 - 11/25 1950

		UNITS	PRICE	VALUE
TIMBERING				
1 LDS @ 330 = 330 6 LDS CON @ 180 = 1080 3 CORS CON @ 110 = 330 } 1740	4 SIDES CHUTE @ 1.35 = 5.40 12 SIDES GOB @ 1.10 = 13.20			5.40 13.20
		1740	.05	87.00
TIMBER TRAM				
cribbing in 3(5x5x1); 3(5x5x2); 5x5x3 = 75+150+75 = 300 @ .04 = 12.00				12.00
cribbing out 3(5x5x1); 2(5x5x2) = 75+100 = 175 @ .02 = 3.50				3.50
BREAKING — ½ CUT				
L x W x H = VOLUME 5x6x7 = 210 → drift brk.	L x W x H = VOLUME 10x6x7 = 420 → raise brk.	210	.115	24.15
10x6x7 = 420 } 630 stope brk. 5x6x7 = 210	10x6x7 = 420 } 1050 stope brk. 15x6x7 = 630	630 420	.045 .09	28.35 37.80
		1050	.045	47.25
HOURS WORKED — NAME: G. Bell, F. State; HOURS: 96, 96				
SHOVELING L x W x H	5x6x7; ½(10x6x7) = 420 BREAKING EXTRA MUCK HOLD BACK + HOLD BACK − TOTAL SHOV. 420	420	.06	25.20
SLUSHING	BREAKING 210+630+1050 EXTRA MUCK HOLD BACK + HOLD BACK − (-105) TOTAL SLUSH 1785	1785	.025	44.63
TRAMMING	all company tram			
FILL	None			
MISCELLANEOUS				
4-5' Sills = 20 @ 7 = 140 units (@ .05 = ...				7.00
1 muck slide @ 1.35				1.35
12 blocks @ .35				4.20
20 ex-girts @ 1.25				25.00
6 slusher floors @ 1.25				7.50
10 spreaders @ .65				6.50
2 Bulkheads @ .90				1.80
4 hours co. time changing slusher @ 1.26				5.04
	58.39			58.39
TOTAL HOURS 192			TOTAL VALUE	386.87

TOTAL VALUE 386.87 / TOTAL HOURS 192 = 2.01 RATE 1 HR.

Figure 5. Data from the standard field sheets and the miscellaneous record are used to make final contract calculations on this sheet.





QUICK CHECK on sink-float performance is furnished with this unit, shown in operating position (left), and with product-collecting baskets raised (right). Pump, at center rear, circulates medium; sample goes into top of higher cone; float overflows into lower cone; sink collects in higher cone's wire mesh basket. Errors are minimized.

How To Simplify Testing For Sink-Float Separation

Here is an accurate, easily-handled, completely new device for testing ores or checking sink-float plant operation

STEPHEN E. ERICKSON
The M. A. Hanna Co.
Hibbing, Minn.

AS THE SINK-FLOAT SEPARATION process comes into more general use it becomes desirable to devise a laboratory testing procedure to determine the amenability of an ore to this process and to check the efficiency of the separation obtained in sink-float plants.

This could be done with heavy liquids, but these are too expensive, in view of the large quantities that would be required to test large sampies of coarsely-crushed ores. Where low specific gravities are required, as in testing coal, carbon tetrachloride or a water solution of zinc chloride are satisfactory. On ores, however, much higher specific gravities are required.

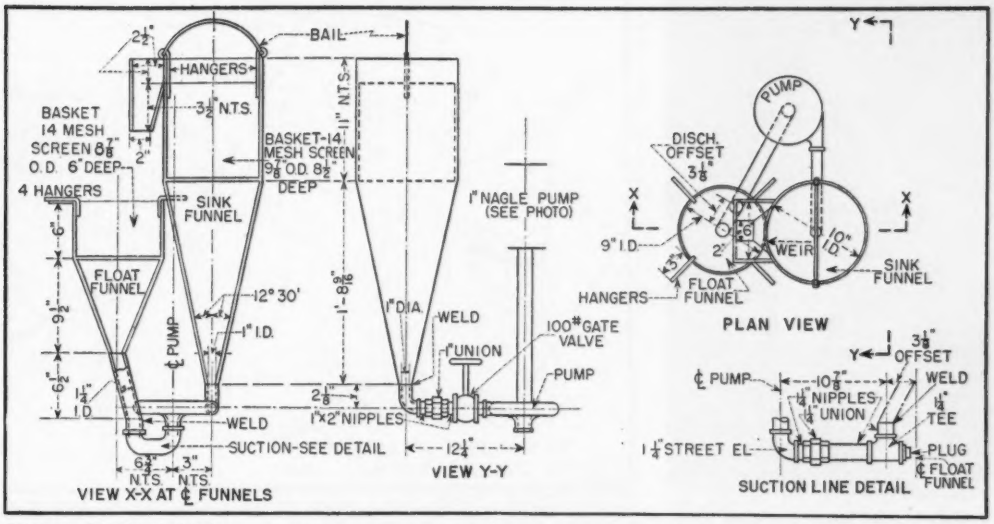
Shortly after the sink-float processes became established, the so-called "bucket test" was devised for laboratory testing. In this test, a portion of regular plant suspensoid medium is used. For greater stability, it is either ground finer than for use in the plant or it is mixed with other materials that will give this effect.

The medium is placed in an ordinary bucket and water is added to give a suspension of the required specific gravity. A large weighted paddle is used to keep the medium in suspension. The ore sample is screened and washed and is then added to the bucket of medium. The float material is skimmed off with an ordinary strainer.

Usually the material remaining in the bucket is stirred up again and the additional float material released is added to the first float skimmings. When all of the material that will float has been removed, the rest of the material remaining in the bucket is poured off through a screen in order to recover the sink product. The float and sink products are then washed in water, dried, weighed and assayed.

The bucket test gives a good approximation of the theoretical separation, but it has a considerable number of draw-backs, such as:

1. It is dependent on the skill and judgment of the operator. Different operators can get rather widely different results.
2. It requires a considerable amount of time for each test.
3. It is hard to maintain specific gravity, which must be checked frequently and adjusted during every test.
4. It is expensive from the standpoint of labor invested per test performed.
5. A true specific gravity separation is hard to obtain because the separation is controlled by other factors such as settling of ore and



SIMPLE CONSTRUCTION makes handling easy. Circulation of medium is down through float funnel to pump suction, up through sink funnel, over lip into float funnel. Circulation merely balances medium's settling tendency.

medium and the velocity of stirring.

The shortcomings of the bucket test were recognized early and many devices have been built in an attempt to improve laboratory sink-float testing procedure.

Practically all of these devices have been built and tested in our laboratory, but the bucket test always proved to be faster, more reliable, or required less labor. These devices and the results we obtained are summarized as follows:

1. Cone-shaped devices in which the float is skimmed off and the sink is removed from the bottom either continuously or intermittently. These devices all have stirrers to keep medium from settling. Two examples of this type were tested. They required an excessive amount of labor and manipulation. The results obtained are more like those obtained in a bucket test because there is a velocity effect due to the stirrer and there is a marked tendency for the medium to settle out.

2. Devices in which the medium is continuously agitated by means of a mechanically driven impeller or by means of compressed air. In these machines the sink is collected in a basket submerged in the medium and the float is removed by skimming. Three examples of this type were tested. Manipulation and labor required were satisfactory, but the separations obtained were hard to duplicate and were unreliable as far as making a separation at a definite specific gravity. These difficulties were due to the high velocity required to lift medium from the bottom of the vessel and keep it in suspension with a mechanical agitator. With the air agitator, the air bubbles in the medium gave an unmeasurable effect on the specific gravity of the medium. In both cases, it was almost impossible to avoid surges and boiling in the medium bath.

3. Several types of drum-shaped devices, rotated on trunnions, were tested. The manipulation and labor required were excessive and the results obtained were not as reliable as those obtained with a bucket test.

4. A device in which the sink was allowed to accumulate in a tank, but the float was skimmed off continuously across a screen. The undersize (mostly medium) was pumped back into the top of the tank, was also tested. The separation obtained and the specific gravity used were unreliable due to settling of the medium and velocity effects. An excessive amount of manipulation was required because the machine had to be stopped in order to remove the sink product, thus the time consumed was greater than with a bucket test.

After a study of the problem, a new and novel machine was designed in which a different principle of operation was used. This machine was built and thoroughly tested and it proved to have all of the hoped for advantages and none of the disadvantages of the others.

This new laboratory sink-float separation testing machine is illustrated in the drawings and photographs. The features of this design are that separate baskets are used to collect the sink and float products, and the medium is circulated by a pump upward against its natural tendency to settle. The pump used has a 5-in. diameter impeller and runs at a speed of 1,200 rpm. The use of a vertical-type pump as shown offers desirable operating advantages because it eliminates tendency of the pump to sand-up when the unit is shut down.

After exhaustive testing of this new design of laboratory sink-float separator the following advantages are apparent:

1. It requires no particular skill or training to operate satisfactorily.

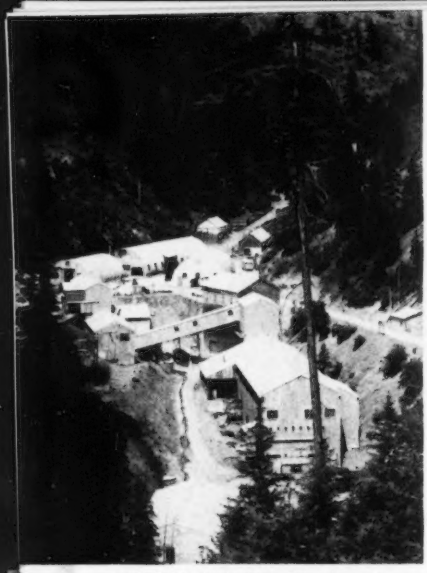
2. Results obtained can be readily duplicated.

3. Labor and manipulation are reduced to 10% to 15% of that required for bucket testing.

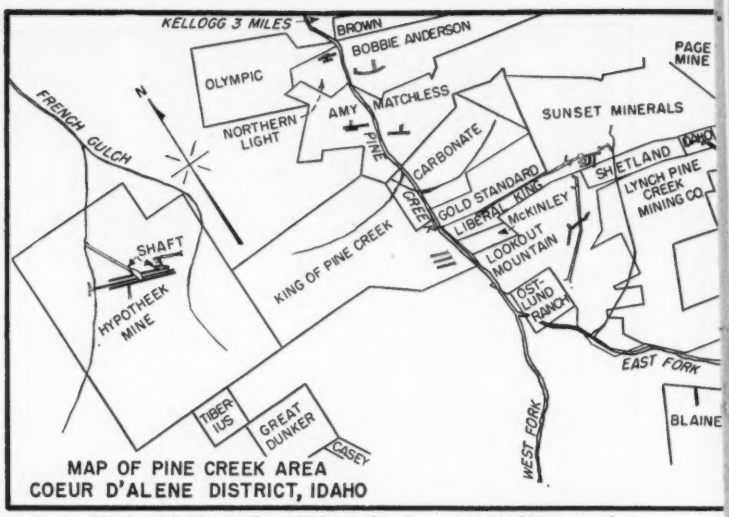
4. The upward current is low enough just to counterbalance the tendency for the medium to settle. This gives a result that is closer to use of a true heavy liquid.

5. Regular plant medium can be used. That is, no special preparation of the medium or no special medium mixtures are required.

6. The amount of medium removed from the circuit is negligible. Therefore, the specific gravity remains constant for long periods.



SIDNEY MINING CO., largest producer, mills about 270 tons daily.



IDAHO'S PINE CREEK AREA which produced some 1,650,000 tons of ore averaging about 3.5% lead and 8.0% zinc from 1942 to 1950, inclusive, de-

Pine Creek—Where Small Mines

SPOKANE-IDAHO MINING CO. (formerly the Constitution) is second largest producer in the area, milling about 180 tons of ore per day.

J. C. KIEFFER, Manager
Spokane-Idaho Mining Co.
Kellogg, Idaho

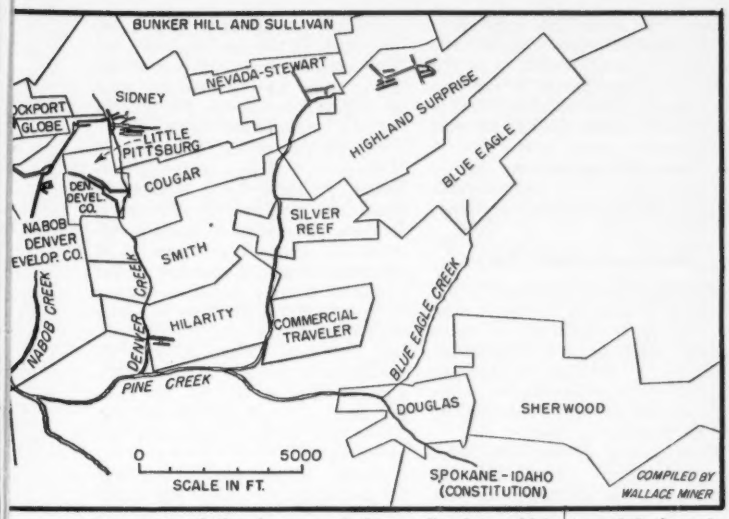
THE PINE CREEK AREA is about 8 miles long by 3 miles wide, extending southeast from the town of Pinehurst, in the central part of Idaho. The Bunker Hill smelter and the Sullivan Mining Co.'s zinc reduction plant are located at Kellogg only a few miles away from the district.

Although Pine Creek is one of the oldest known mineral bearing areas in the Coeur d'Alene district, it has been one of the most maligned. Many claims were located on Pine Creek before the turn of the century. Following original discoveries, much money was spent in opening up the deposits and in building mills. Prior to 1940 none of these attempts resulted in successful operations on a continuing basis. Reason for these failures were as follows:

1. Ore deposits had more zinc than lead. For many years zinc was more detrimental in lead ore than gangue because the lead smelter assessed a much higher penalty against it. Even lead-free zinc ore when shipped to a zinc reduction plant, brought very little return. Because of these conditions no zinc ore was produced in the Coeur d'Alenes prior to 1905, and for many years after 1905, the only zinc ores produced were from extremely rich bodies containing little lead.

2. The problem of separating the zinc and lead minerals from each other was in most cases so difficult as to be beyond solution with jigs, tables and vanners, the machines then in use.

3. Transportation facilities for the area were poor. This shortcoming was about to be overcome in 1917, when railroad surveys were made from near the present town of Pinehurst to the Highland-Surprise and Constitution mines. Work was begun in the fall of that year. The project was abandoned, however, in 1918 after several miles of road bed had been built. The money



serves commendation because of the small mines which struggled through years of adversity, eventually to become important producers of strategic metals.

HIGHLAND SURPRISE MINING CO. mills about 100 tons daily.

Are Becoming Major Producers

which had been advanced for the venture suffered the same fate as most other capital put into the Pine Creek area up to that time.

Fortunately, since the early day failures, much has been learned about the geology of the area, and successful milling methods for Pine Creek ores have been developed. A network of roads has been built to make operating mines and most of the prospects readily accessible.

How the Orebodies Occur

While the geology of individual properties is invariably complex and still presents some unsolved problems, the real picture is now quite well known. All the ore deposits are in the Prichard Formation, which is the lowest of the Belt Series of Pre-Cambrian sedimentary rocks which underlie the Coeur d'Alene mining district. The Prichard consists of blue shales and slates with subordinate interbedded gray sand stones and quartzites. In the Pine Creek area the formation is separated into upper, middle and lower members by several massive beds of quartzite that occur within the series. The upper Prichard is 5,000 to 6,000 ft. thick; the middle Prichard from 1,800 to 3,000 ft.; and the thickness of the lower Prichard is not known because its base is nowhere exposed in this vicinty.

SUNSET MINERALS, INC., is the third largest operation in terms of current production. Approximately 100 tons of ore are being milled per day.

Most of the ore deposits lie along a zone of major fracturing which extends from the Highland-Surprise mine to the Hypotheek mine. This zone runs in a northwesterly direction and is about five miles long. The principal structural features of the area, in addition to the fracturing, are the Placer Creek fault, which lies to the south and roughly parallels the ore zone; the Pine Creek anticlinal axis, which follows an irregular course between the Placer Creek fault and the fracture zone; and the middle Prichard quartzites, which intersect the fracturing. This intersection occurs in some instances within the present mine workings, and in other instances below any present workings.

Three properties, namely, the Hilarity, the Douglas and the Spokane-Idaho (Constitution), lie south

of the Placer Creek fault. These properties do not appear to be on the zone of major fracturing previously described. However, the block south of the Placer Creek fault has been moved to the west, and the three mines may, in fact, lie along a displaced extension of the main fracture zone.

Ore deposits along a given shear are localized within zones in which the ability or competency of the wall rock to maintain openings is greater than elsewhere. To cite examples, at Sunset Minerals (Liberal King) the oreshoots are localized in and near the intersection of a fracture zone with the hard, competent middle Prichard quartzites, as is the case at the Hilarity; at the Spokane-Idaho, the vein lies in the top of the upper Prichard, in a zone in which beds of competent quartzites occur along with the incompetent slates, and the rake of the orebody corresponds closely to the dip of the beds; and at the Sidney, where no quartzites occur, the competency of the slates was increased markedly by folding before the ore-bearing fractures were made and the ore deposited.

Major Metal Is Zinc

The major economic mineral in Pine Creek ores is sphalerite, although two properties, the Hypotheek and Lookout Mountain, have lead ore (galena and cerrusite) with very little zinc. At the Sidney and at Sunset Minerals the normal ratio of zinc to lead is about two to one; at the Highland-Surprise the normal ratio is about three to one; and at the other properties it is between these extremes. The silver content ranges from 0.2 oz. to 0.6 oz. per unit of lead. Some gold and copper are present, although usually little more than traces.

Pine Creek ores characteristically have a fine-grained texture. This is particularly true of the Sunset Minerals, Douglas and Spokane-Idaho ores. Compared with these three, mineralization at the Nabob, Little Pittsburg, Sidney and Highland-Surprise is much coarser grained. However, even at the properties where the grain size is normally very fine, occasional zones are found where coarse mineralization exists. These zones are usually on the extremities of the orebody or in the walls of the vein.

The common gangue minerals are quartz, pyrrhotite and pyrite. Small amounts of calcite and siderite are usually present. Where massive pyrite exists the veins are usually barren; but if the iron sulphide is in the form of pyrrhotite, lead values are commonly found also. The presence of pyrrhotite, which is a high temperature mineral, puts the Pine Creek ores in the hypothermal classification; most other ores in the Coeur d'Alene mining district are considered to be mesothermal, or in the middle temperature range.

Mining Methods Vary

Mining methods vary greatly over the area. In general, however, most of the ore is extracted by three mining methods: (1) Shrinkage stoping; (2) cut and fill stoping; and (3) stull set stoping, in which the caps are cut to fit the ground, and no framing is used.

Most drilling is now done with tungsten-carbide bits, although some properties are using one-pass steel bits, and other properties continue to use threaded steel bits.

Development waste is commonly used for filling. At the Spokane-Idaho plans are going forward to augment this source of waste with sands from the mill tailings. Other properties are also considering the use of sand filling.

At the Sidney Mining Co., the area's largest producer, wall conditions are very good. Because of this circumstance whenever ore widths are less than 15 ft., shrinkage stoping is used. If the widths exceed 15 ft., and they sometimes get as wide as 25 ft., cut and fill stoping is the method employed. Production from the Sidney mine keeps their mill running seven days per week at the rate of about 270 tons per day.

The next largest producer is the Spokane-Idaho Mining Co., which is the only mine in this area, and one of the few in the Coeur d'Alenes, where the vein is substantially vertical. This vein is also unique in that its strike is nearly north and south in contrast with the normal east-west strike of other Coeur d'Alene veins. Two mining practices are followed: cut and fill, and stull set timbering. If ground conditions are bad because of strike faulting, or vein widths are very narrow, or close sorting must be resorted to, cut and fill stoping is done; for all other conditions, stull set timbering is used. The Spokane-Idaho is milling about 180 tons per day and operating their mill seven days per week.

The third largest producer is Sunset Minerals, Inc. The mining method used is stull set timbering. The dip of the vein is quite flat, ranging from about 20 deg. to 50 deg. Most of the ore runs into the level chutes by gravity, but if the dip is below 40 deg. slushing must be resorted to. About 100 tons of ore are being milled daily.

Highland-Surprise Consolidated Mining Co. has been a large, consistent producer for a number of years. At present, production is somewhat curtailed to allow a vigorous development program to be carried through. About 300 ft. per month of drifting and cross-cutting is being done, in addition to a considerable amount of diamond drilling. For vein widths up to 4 ft. shrinkage stoping is used, and for wider widths, up to 9 ft., the mining method is cut and fill stoping. About 110 tons of ore daily are being milled.

Mascot Mines, Inc., is a newly formed company which has taken over the Little Pittsburg mine, formerly operated by the Denver Development Co. There has been no change in management. Stull set timbering is the mining method used. Currently, a development program is being accelerated. Upon the completion of this program a sizable increase in production is expected. About 70 tons of ore daily are being milled.

The Nabob Silver-Lead Co. mine is under active development. Five favorable structures were cut in their new 6,425-ft. crosscut, and each of these structures will be explored. The work now being done is on the Crystolite vein. Development on this vein has opened up milling grade ore, which is being processed in the company's 300-ton selective flotation concentrator.

Other mines which are not in production but where development work is being done include the Nevada-Stewart, the Hypotheek, and Lookout Mountain.

Shaft Sinking

As in most other mining areas, the Pine Creek mines were forced to allow development work, especially shaft sinking, to lag far behind production during World War II. Even now this condition of unbalance has not been entirely eliminated. As a consequence all the producing mines have a shaft sinking program in progress, have just completed one, or are just starting one.

At the Sidney, where all ore now being milled comes from above the Red Cloud tunnel, which is the main haulageway, a 400-hp. double-drum hoist was recently installed. Shaft sinking in a three compart-

ment vertical shaft has progressed to the 1,100-ft. level, which is 1,100 ft. below the outcrop and 200 ft. below the Red Cloud Tunnel, where the hoist is located. A station and pocket are being cut on this level. As soon as this work is completed a crosscut for the vein, 125 ft. away, will be started, and at the same time shaft sinking will be resumed.

New Hoist for Spokane-Idaho

At the Spokane-Idaho a sinking program which extended the three-compartment vertical shaft from the 1,000-ft. level to the 1,600-ft. level has just been completed. This project opened up 200 ft. of new ground below the last working level, since a winze had previously served from the 1,000 level to the 1,400 level. Work on the 1,600 station and pocket is substantially finished, and drifting on the 1,600 level has begun. Sinking in the main shaft will be resumed by March. The Spokane-Idaho is also driving a new rope raise and cutting a new main shaft hoist station preparatory to the installation of a 400-hp. double-drum, tandem-drive hoist now being built by the Coeur d'Alene Hardware and Foundry Co. This hoist will incorporate many new design features, such as electrically operated brakes and clutches, instead of the more common hydraulic type.

Sunset Minerals, which has been mining the 1,100 level and the 1,200 level through an inclined winze from the 1,000 level, has holed through a pilot raise from the 1,200 level to the bottom of their 1,000-ft. two-compartment vertical shaft. This raise will be enlarged and timbered to extend the main shaft to the 1,200 level. The inclined winze is being sunk from the 1,200 level to the 1,400 level, with the job now about half finished. The winze, which follows the vein, is in good grade ore.

The Highland-Surprise has finished sinking their two-compartment inclined shaft to the 1,450 level, and is drifting on that level.

Mascot Mines, whose main haulageway is the No. 6 level, is deepening their two-compartment 62-deg. inclined shaft from the No. 8 level, which is 300 ft. on the incline below No. 6, to the No. 6, to the No. 10 level. At this writing the shaft crew is down to the No. 9 level, and is cutting a station and pocket there. When the station and pocket are finished, a drift crew will start driving the 125-ft. crosscut to the vein while the shaft crew returns to its sinking job.

Lookout Mountain Mining and Milling Co. is doing work preparatory to sinking their shaft, which is 225 ft. deep. The objective is a thrust fault believed to be 75 ft. below the present bottom of the shaft.

Ore Is Fine Grained

The fine grained texture of the Pine Creek ores makes milling a difficult problem. If the ores are ground fine enough to liberate the minerals a satisfactory separation can be made. Two properties which are milling fine-grained ore, the Spokane-Idaho and Sunset Minerals, have experimented with regrind circuits. At the Spokane-Idaho, which has the most difficult milling problem of any of the producing Pine Creek operations, this experiment has turned out successfully. The present flow sheet includes one regrind mill for the lead rougher concentrate, and a second one for the zinc cleaner tails. The final lead concentrate is 99% minus 325 mesh and 90% minus 325 mesh, and the zinc concentrate is somewhat coarser. Fortunately the galena shows a remarkable resistance to sliming at whatever grind. The sphalerite is much softer, and, if ground too fine, complicates thickening and filtering problems unduly. At the Sidney a slightly different approach to the regrind problem is in effect: here the "flash grind," described in the January, 1950, issue of *E & M J*, by Frank McKinley, assistant mill superintendent for the Bunker Hill and Sullivan Mining and Concentrating Co., is used.

The flotation reagents in all these circuits are the same as those generally found in zinc-lead mills: soda ash and lime for alkalinity control; cyanide and zinc sulphate for zinc depression; ethyl, amyl and isopropyl xanthates, and the Aerofloats, for collection; cresylic acid and methyl isobutyl carbinol for frothers; and copper sulphate, which several properties now buy in solution, for zinc activation.

Present and Future

The zinc producing area on Pine Creek is the largest one in Idaho, which in turn leads the nation in zinc production. The Sidney and the Spokane-Idaho have been among the top ten zinc mines in Idaho for the past several years, and Sunset Minerals joined this group in 1950. The Highland-Surprise and the Little Pittsburg (Mascot Mines) have been consistently large zinc producers over an extended period.

While the lead production from the area is much less than its zinc production, Pine Creek turns out considerable tonnage of lead concentrates. The Sidney has for several years been among the top ten lead producers in Idaho. In 1950 the Spokane-Idaho was also in the top ten lead producing mines.

In production of ore mined the estimate for Pine Creek up to 1942 is 1,000,000 tons; and from 1942 to 1950 inclusive, about 1,650,000 tons. Probable grade is in the neighborhood of 3.5% lead and 8.0% zinc.

Developments since 1942 and the continuing high demand for zinc make the outlook for Pine Creek appear very good. Up to now no mine has closed because of the bottoming of its ore shoot. This, and the fact that all of the Lower Prichard Formation constitutes a vast unexplored zone which has not been examined anywhere, give the present producers many years of possible life. In addition, other properties not now in production will if properly developed become sizable producers of zinc and lead, and will add to the already large production of the Pine Creek area.

New Ore Encountered

Both Nevada Stewart and Highland-Surprise mines have recently encountered new faces of milling ore according to Frank J. Luedke, president of both companies. The vein on the 700 level of the Nevada Stewart which was opened up in April, has been followed for 70 ft. westerly, of which the last 20 ft. has been taken for ore. The ore occurs in separate narrow seams of high-grade galena, and is vastly different from the finely disseminated zinc-lead ores common to the Pine Creek area. Full-width drift assays ran 5% lead and 6 oz. silver per ton.

The west drift of the Highland-Surprise mine on the 1450 ft. level has been in good high-grade lead-silver ore for more than 60 ft. The mineral structure varies from 1 to 3 ft. in width, and averages about 20% lead and 18 oz. silver per ton, with a small amount of zinc. The new ore exposure is believed to be the downward extension of the Surprise No. 2 ore shoot mined on upper levels.

It has also been reported recently[1] that the Sunset Minerals company is considering increasing its mill capacity from 3,000 to 4,000 tons per month.

[1] According to recent reports in the *Wallace Miner*.

Three Steps Toward Solving Mining's Manpower Problem:—

1. What Defense Minerals Administration Has done.

Had metal miners put on Dept. of Labor's critical occupation list.
Had mining, milling, and smelting listed as defense-essential industries.
Prepared data to show need for blanket deferment for skilled miners.

2. What Defense Minerals Administration Can Do.

Help in getting deferment for reservists.
Advise on best use of U.S.E.S. and other Government aids.
Argue industry's case in Government.

3. What Mining Companies Can Do.

Don't wait for Government to handle manpower problem.
Determine accurately and honestly why people are leaving your mine.
Make wage and working conditions as attractive as possible.
Work closely with local draft boards.
Start vigorous recruiting campaign.
Develop effective training programs.
Employ women wherever possible.
Use foreign workers under Displaced Persons Act.

You Can Do Something About Manpower

STEPHEN W. WOOD
Manpower Branch
Defense Minerals Administration
Washington, D. C.

THE DEFENSE MINERALS Administration—your claimant in Washington on defense matters—is eager to help the producers of defense-essential materials with their manpower problems. In certain cases it can give real assistance. However, you cannot afford to depend entirely on Government action. To achieve reasonable safety, the mine operator must make a very determined effort himself.

What DMA Has Done: Upon presentation of the facts by DMA, the Department of Labor has included the classification of "Metal Miner, Underground" on the list of critical occupations. Also, the Department of Commerce has listed "Metal and Non-Metallic Mining and Milling" and "Smelting, Refining and Processing of Metal" on its list of defense-essential industries. Both these lists are for use by Selective Service and are in the hands of local draft boards. However, mine operators and employees should understand that deferment is not mandatory. The lists are to assist local draft boards in making their decisions. They are merely policy guides, not instructions. The decisive power remains in the hands of the local boards. It is up to the mine operator to present the facts and argue the merits in each individual case for which deferment is sought.

DMA is assembling data which it is believed may demonstrate the advisability of setting up blanket deferments for skilled workers in mines, mills, and smelters. At the present time, however, there is not definite assurance, but simply possibility, that blanket deferments will be created. It would be foolish to relax on other ways of solving the manpower problem just because of this possibility.

What DMA Can Do: DMA can give you help in obtaining deferments of reservists in especially meritorious cases. However, deferment should only be sought for persons in "critical occupations" or key jobs designated as essential. There should be ample *proof* that the loss of the personnel in question would seriously interfere with defense production. The military services are fully aware of the close relationship between defense production and military requirements. Appeals made by employees to secure delayed military induction should be made as quickly as possible and pursued to the highest available point of appeal. This should be considered as a cooperative procedure through which the metal producing industry and agencies of Government may work toward the greatest accomplishment in the national interest. It should not be considered as a means of evading military service. Bear in mind that, if delayed activation is agreed to by the military services, it is in recognition of the greater contribution toward the national defense that the individual may make by remaining in his civilian job.

DMA, insofar as justified by the facts, can work and is working toward securing blanket deferment for defense in regard to reservists and Selective Service. However, DMA's ability to help the industry in this respect depends greatly on

the help it gets from the industry in the way of facts, figures, and case histories. Given sufficient convincing information that such deferment would be in the national interest, we feel sure we can make progress along this front.

What You Can Do: As stated before, it is folly to gamble with such a vital problem as manpower by depending solely on what Government does. Government is hampered by size, by the demands of defense, and by the necessity of dealing equitably with all the claimants for special consideration and the public. The resourceful operator can do a great deal to help himself.

A first and necessary step is to determine without prejudice what makes the kind of people you want come and stay. This may seem to point up the obvious, but it is surprising how many employers permit themselves to be misled by pet notions and prejudices. One method of finding out is to interview departing personnel to find out why they decided to leave.

Everyone, of course, knows that, whatever other factors may influence employees, there is strong interest in the size of the paycheck; the conditions, hazards and comforts of work; the atmosphere of square dealing; and housing and community attractions. With its inherent hazards, and often darkness, dampness, and inconvenience in working places, mining has a particular job to do toward improving those aspects of working and living conditions that it is able to alter. Probably an effective job cannot be done unless a very strenuous effort is made to get the industry's wage levels on a truly competitive basis. After all, most of the manpower losses of the last war were not due to the taking of personnel into the armed forces, but were due to competition by other industries, armed in many cases with cost-plus Government contracts.

The taking of men by Selective Service will continue to be pretty much up to the discretion of local draft boards. Even if blanket deferments are provided, they are likely to pertain only to certain selected occupations in mining. Therefore, it is of the greatest importance that operators should strive to make local boards fully aware of their problems and the contributions which they are making to a sound defense program. This is a time-consuming and often frustrating job, but one that is well worth while.

Recruitment has often proved to be a difficult task and recruits unfamiliar with mining areas and life are likely to show a high turnover. Nevertheless, a vigorous recruitment campaign is worth while. The following suggestions represent experience which has produced results:

a. Enlist the efforts and cooperation of the U.S.E.S. local office and arrange for assistance in local recruitment, and recruitment outside the area, if necessary.

b. Advertise as widely as recruitment is planned, pointing out the attractive aspects of the jobs offered such as permanence of employment, social security benefits, bonuses, overtime possibilities, safety measures, housing, living conditions and climate, if attractive. The importance of metal production to the defense program should be stressed.

c. Relax job specifications in terms of experience, age, and physical qualifications where possible.

d. Appoint representatives to follow recruitment itineraries, to interview applicants and make firm hiring commitments.

e. Arrange for the transportation of workers from the point of hire to the place of employment. Such advances may be deducted from the subsequent earnings of the worker over a reasonable period of time. As a bonus for remaining on the job, it may be well to provide that such deductions will be returned to the worker after some agreed period of continuous employment.

The training of men and women for metal production jobs represents a promising, but less accepted, method for increasing levels of employment. Many large metal producers have already utilized the training approach as a means both for improving and expanding their working forces. The promotion of training, and its extension to smaller producers, seems clearly to be one method through which the industry, with the possible assistance of the training agencies of Government, can meet one phase of its manpower problem.

The training of women is by no means a fantastic idea, and proved effective during World War II. (The January issue of the *Engineering and Mining Journal* contained on pages 63 to 66 an article concerning the use of women in the metals industry during World War II.) The utilization of women in all jobs for which they are qualified or can be trained is a possibility that should not be overlooked even prior to the time that any serious and general shortage of manpower develops.

The utilization of workers from foreign countries may ultimately be desirable and perhaps essential, to insure the expansion of employment to keep abreast of increased metal production requirements. The Displaced Persons Act provides a potential avenue through which European workers with previous metal mining experience may be secured. The number of such workers available has not been precisely determined up to this time, but information as to their availability is to be developed soon. Meanwhile, the conditions under which workers may be brought to the United States under the Displaced Persons Act should be considered. Basically, these conditions are as follows:

a. Suitable jobs must be available, at prevailing wages, without displacing American workers or preventing Americans from securing employment.

b. Adequate housing must be available at a cost no greater than that charged American workers.

c. Assurance must be given that the immigrant will not become a public charge.

d. Transportation must be provided from the port of entry to the location of the job by someone other than the immigrant. (This may be provided by the employer, some interested charitable organization, or church group. Under some circumstances the Government will loan funds for transportation purposes.)

The possible utilization of Mexicans should not be overlooked, particularly to the extent that experienced men are available and to the extent that less experienced personnel are usable in open-pit operations. During the last war it will be recalled that it was necessary to bring Mexicans to this country for agricultural jobs and other industries. At the present time a large number of Mexicans is eager to obtain work in the United States.

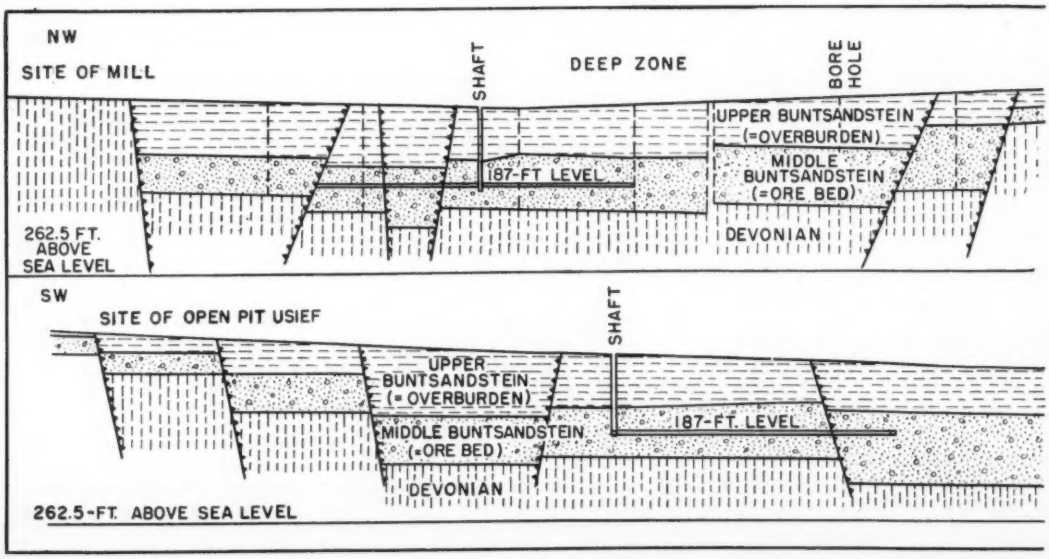
If the mining industry will exert itself strenuously to solve its manpower problems and will help DMA present its case properly in official circles, we have high hopes that many of the manpower problems of World War II can be averted, and that the industry can go ahead with the job it has to do.

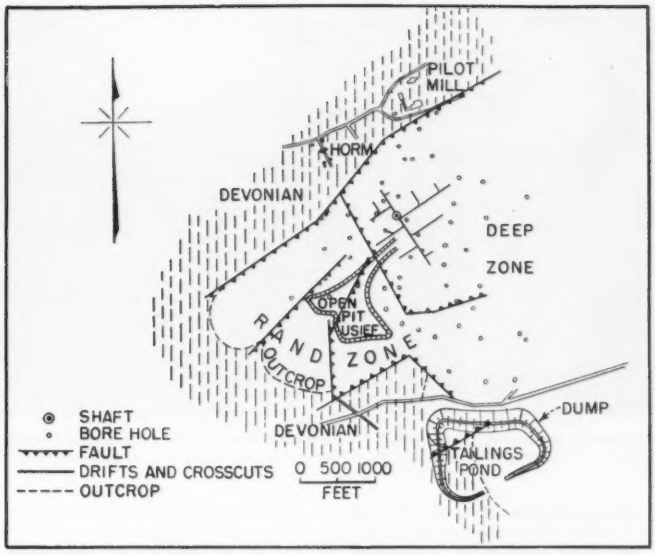
PRODUCTION at Maubacher Bleiberg currently comes from Usief open pit. Deposit extends in general to right. Arrow points to Voight shaft and well drilled by cable tools for dewatering ground. Compare with map (right).

A Promising Lead-Zinc District

With 30 million tons of 6% ore in sight, Maubacher Bleiberg looks to large-scale operation and special equipment to solve its economic and metallurgical problems

HANS FRITZSCHE
Maubacher Bleiberg Mine
Stolberger Zink Co.
Düren, Germany



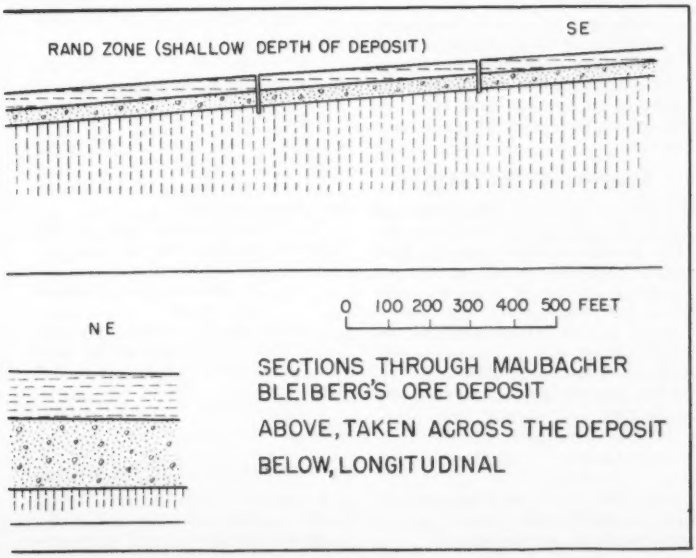


RELATION OF PRESENT OPEN PIT to deep zone is indicated. Iron-bearing formation outcrops in left center. Deeper portion may also be mined as pit.

Awaits Development

ALTHOUGH THE LARGE DEPOSIT OF low-grade lead-zinc ore on the Maubacher Bleiberg property, near Düren in the Rhineland, has been known since the 13th Century or longer, its history reveals no period of important activity except that of exploration. The only effort at mining, in 1874-79, failed, mainly because of the oxidized character of the ore near the outcrop and the inadequate milling methods of the time, even for sulphide ore. In 1901, the concessions were taken over by Stolberger Zink A.G. für Bergbau und Hüttenbetrieb, at Aachen, the present owner. From 1904 to 1908 this company did development work comprising about 4,265 ft. of drifts, raises and winzes. At that time, however, a large deposit of low-grade lead ore was uninteresting as long as sufficient tonnages to meet the smelter demands could be mined in high-grade deposits or could be imported.

Eventually the exhaustion of high-grade orebodies, the deficiency of lead ore on the world market, and the development of the flotation process changed conditions entirely. After a detailed study by Dr. A. Voight and a short period of state activity in prospecting and exploratory work from 1938 to 1944, the Stolberger Zink company began definitely to open up the property. This was shortly after the war.


RAND ZONE (SHALLOW DEPTH OF DEPOSIT)
SE
NE
0 100 200 300 400 500 FEET
SECTIONS THROUGH MAUBACHER BLEIBERG'S ORE DEPOSIT
ABOVE, TAKEN ACROSS THE DEPOSIT
BELOW, LONGITUDINAL

Geology

The lead-zinc deposits of Maubacher Bleiberg occur in the Triassic Buntsandstein formation, which overlies unconformably the Devonian beds that compose a good part of the Eifel Mountains, on the southeastern slope of which the property is situated. The deposit is on the northern edge of the so-called Buntsandstein triangle. On its southwestern side the triangle contains the deposits of Mechernich, famous lead mine centuries old.

The formation is divided into the upper and middle Buntsandstein. The upper member, representing the overburden, consists of a series of red loam beds, loamy conglomerates and thin layers of red sandstones, having a total thickness ranging up to 131 ft. The ore deposit is in the Middle Buntsandstein, a series of light-colored sandstones and conglomerates 98 to 164 ft. thick. Near the outcrop and in a typical rand zone, the ore bed flattens out, due either to its original thickness being less near the shore of the sedimentation basin, or to reduction later by faulting and erosion. As the deposit is in the fracture zone between the Paleozoic and Mesozoic of the Eifel Mountains and the Tertiary of the Lower Rhineland, the whole series became intensively cut and shattered. While

CARBIDE DRILLING with tipped steel and airleg set-up is done both underground, for development work now under way and in the open pit for current production. Machines used are 44-lb. Bergmeisters made by German firm Demag.

most of the cuts and fissures encountered every 2 or 3 ft. show little or no movement, some of the main faults caused a considerable displacement resulting in a typical trough or staircase structure (see the accompanying profiles) affecting greatly the decision as to mining method to be used. Thus, a rand zone of the deposit (see map) can be identified where the overburden is thin or missing and the thickness of the ore bed goes down to 39 ft., whereas the main part has about 131 ft. of ore. While mining began as usual in the rand zone, the deep zone will be far more important in the future.

The Mineralization

Maubacher Bleiberg's ore deposit is characterized as an impregnation of the sandstones and conglomerates by galena and sphalerite as main constituents and by some chalcopyrite and pyrite as accessories. As so far known, most of the rock is sandy conglomerate, in which the pebble size varies from 1 to 10 in. The ore minerals are in the cement between the pebbles as long as it was permeable. The pebbles themselves, originating from Paleozoic and pre-Paleozoic formations, are barren of metal except in small cracks. Pure sandstones are rare; they are irregularly interbedded within the conglomerates. If the sandstone is friable, it carries numerous pea-shaped so-called "knotten" of galena. This Mechernich type of ore is rare at Maubacher Bleiberg. Here, the sandstones are highly silicified with a very fine-grained mineralization between the angles of the sand grains or as a coating on their surface. A large part of the sandstones and the conglomerates is dolomitic. In this latter rock, being less ready for a thorough impregnation, the galena prefers planes, cracks and cavities or forms small rosettes of 0.04-0.08 in. in diameter.

In general the mine's sphalerite is fine-grained and very light-colored. The chalcopyrite, occurring in small veinlets and in the neighboring rock, seems to prefer zones of dolomization. The copper in the crude ore, varies considerably but the percentage never is big enough to warrant making a concentrate.

Nothing final can be said as to the origin of this unique deposit. The trend of opinion is that hydrothermal processes had a deciding part in connection with the thorough shattering of the whole rock series.

Reserves of Horm Section

Out of the total concession, an area of approximately 5.5 sq. mi., the former activity was confined to a relatively small section of about a quarter of a square mile. The following notes and figures relate to this "Horm section," so-called because it is near the small village of Horm. Within its boundaries, knowledge is based on the following development work:

1. Former (up to 1944):
   5,248 ft. of drifting in the orebody.
   3,411 ft. of vertical development work.
   5,248 ft. of boring.
2. Present (since 1948):
   4,920 ft. of boring (in 15 bore holes).
   5,904 ft. of drifting (to Oct., 1950).

According to this development work, the Horm section contains about 30 million tons of ore with about 1 million tons of produceable metals, that is 1.3 to 1.4 tons of produceable metal per sq. yd. of surface. To be conservative, this calculation is based on 2.5% Pb and 1.3% Zn, where the actual average assay is much higher, as shown later.

The overburden-to-ore ratio, in the shallow part of the deposit as well as in the deep one, is almost uniformly 0.78 cu. yd. of overburden to 1 ton of ore.

A Program Is Drawn Up

When the Stolberger company started work in 1947, the following program was drawn up:

1. General preparations necessary to open mine.
2. Precise examination of the reserves of the Horm section.
   (a) By boring.
   (b) By underground development work.
3. Opening of primary open pit and decision as to mining method.
4. Construction and operation of a pilot mill.
5. Exploration beyond the borders of the Horm section and outside the concessions; planning for a definite plant on large scale.

1. General Preparations. These must be mentioned because in the most destroyed part of Germany

OPERATION OF PILOT MILL over two years has yielded adequate ore-treatment process. Flotation is assured. Problem is crushing and grinding.

under the postwar conditions of 1947 the construction of any new work was almost impossible. The whole region including the roads was greatly damaged. Not a single tool, hut, or other piece of equipment was at hand, nothing was left of former activity, no square yard of ground owned, not even a single room available in the vicinity to house staff members. One year was necessary to rebuild a destroyed power line a few miles long and to get a telephone connection. Not a single brick could be furnished up to July, 1948. Thus, the work began on a most primitive scale. Conditions, however, improved rapidly after the currency reform of June, 1948.

Carbide Drilling Used

2. Drilling and Development Work. The most important drilling job was to prove the reserves of the Horm section by a series of bore holes. Drilling was done by rotary system with fish-tail bits in the overburden and tungsten carbide-tipped roller bits in the ore deposit. Unfortunately experiments failed to get cores in the extremely hard and variable conglomerates.[1] Thus, while proving the assumed thickness of overburden and ore, drilling did not give exact results as to ore grade, although a fairly good estimate could be made by watching the sludge (wash samples) continuously. Another handicap was the frequent losses of the flush in cavities and open fissures. For these reasons, drilling had to be assisted by underground development. Nevertheless, a new core-drilling device was developed, which has given good results in tests, and will be put into operation soon.

Underground development work was begun at the end of 1949. An old shaft had to be dewatered to the 119-ft. level. At present it is being deepened to the footwall of the ore. Inasmuch as the sandstones and conglomerates contain a large amount of water, the dewatering had to be done indirectly by a pump well 295 ft. deep and 23.6 in. in diameter which had been drilled with cable tools, a tough job in the hard rock. Drifting and crosscutting on the 187-ft. level is done on a rectangular plan to get an average picture of the deposit (see map).

The tunnels are about 86 sq. ft. in cross section and have to be timbered close to the face, because the rock, due to numerous faults and bedding planes, tends to slab off. Drilling is done wet by Demag hammer drills of the Bergmeister type mounted on an air leg. This air hammer weighs about 44 lb., has a light blow and fast rotation and is especially designed for tungsten-carbide-tipped drills. The latter are of ⅞-in. hex. steel with a chisel-type bit and carbide insert. Because of the small diameter of the steel, the bits are not detachable, but have the insert brazed directly into a slot in the bit. The rod is of steel of such quality that it lasts for the life of the carbide insert. Bits are reground about 8 to 10 times in an underground shop on grinding wheels turning at 82 fps. Bit gage is finally reduced from the original 1.57 in. to about 1.1 in. Average footage for all drills used since the beginning is 377 ft. per drill.

From 25 to 30 holes are necessary to drill a round, a combination of wedge cut and pyramid cut being used, depending on the rock. Drilling in the variable conglomerate with constantly changing conditions is very difficult. Frequently the steel sticks or the holes, when finished, are blocked by pieces of rock and cannot be loaded. Gelatin is used in blasting, the holes being fired electrically, using as many as eleven delays. Powder consumption is about 2.5 lb. per cu. yd. of rock.

Mucking is done either by hand or with loading machines. The Atlas-Diesel LM35 loader has proved reliable. Development work is now at a rate of about 787 ft. a month. The average advance for all headings is 10.2 in. to 11.8 in. or 28.26 cu. ft. per man-shift, including all work such as laying track, timbering and tramming to the shaft.

Underground ore is handled separately in the mill, giving an exact average of ore grade. In addition a detailed sampling of individual headings is used if necessary. After almost a year's development work, the mineralization can be said to be almost uniform throughout the ore.

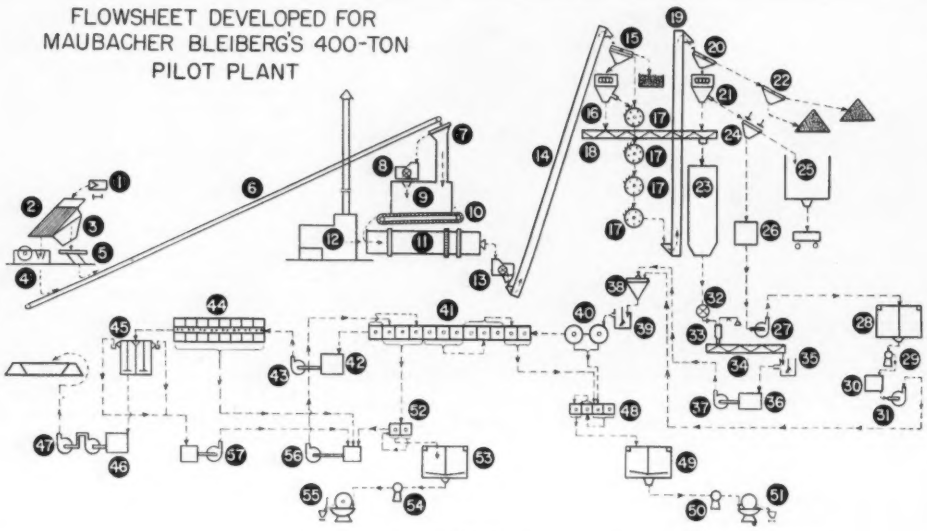
Monthly averages vary from 2.4 to 3.6% Pb and 1.8 to 3.6% Zn. The total varies from 4.6 to 7.1% combined lead and zinc.

Open Pit vs. Underground

3. Choice of mining method. (a) Rand zone of deposit. The primary Usief open pit in operation since July, 1948, was opened in the Rand zone which, with its 16.5 to 65.5 ft. of overburden and 39.3 ft. of ore, is a typical open-cut proposition. Because of the provisional character of the job, work is done by a contractor. Stripping is done by two 6½-yd. steam shovels at a rate of 1,308 cu. yd. a day. The material is hauled in self-dumping 21-cu. yd. cars with steam-driven locomotives on 35.-44-in. gage to the dump, where it is used to build a large dam for the tailings pond. The soil has to be dumped separately for recul-

[1] Diamond drilling, for lack of diamonds, has not been possible in Germany until this year. A recent test with modern Swedish-made equipment (Craelius X-4 machine) and diamond bits turned out to be too expensive because of extraordinary wear by the highly abrasive rock.

FLOWSHEET DEVELOPED FOR MAUBACHER BLEIBERG'S 400-TON PILOT PLANT



LEGEND

1. 10-ton self-dumping car
2. Screen, 60-mm. openings
3. Pocket
4. Jaw crusher, 19.7 x 39.4-in. opening
5. Feeder
6. Belt conveyor
7. Vibrating screen, 40 mm.
8. Impeller breaker, AP-3
9. Bin
10. Apron conveyor
11. Drying drum
12. Furnace plant
13. Impeller breaker, AP-1
14. Bucket elevator
15. Screen, 30 mm., for protection of air separator
16. Air separator
17. Disk breaker
18. Screw conveyor
19. Bucket elevator
20. Screen, 3 mm.
21. Air separator
22. Screens, 8 mm., producing two sizes of sand for building purposes —3-8 mm. and 8-30 mm.
23. Flotation bin
24. Wet screen, 0.25 mm.
25. Bin for sand, 0-3 mm., to dump or be used for building purposes
26. Sump (surge box)
27. Pump
28. Thickener
29. Pump
30. Sump
31. Pump
32. Rotary feeder
33. Automatic balance (hopper scale)
34. Screw conveyor
35. Conditioner tank
36. Sump
37. Pump
38. Cone
39. Conditioner tank
40. Flotation, round cells—lead rougher
41. Flotation cells—lead and zinc rougher
42. Sump
43. Pump
44. Flotation cells
45. Flotation deep cells
46. Sump
47. Two tailings pumps, pipe 6,500 ft. long to pond
48. Flotation cells—lead cleaner
49. Lead thickener
50. Pump
51. Filter for lead concentrates
52. Flotation cells—zinc cleaner
53. Zinc thickener
54. Pump
55. Filter for zinc concentrates
56. Pump
57. Pump

tivation, being too valuable to waste.

The ore bed in the Usief pit is 39.4 ft. thick. The lower bench of the overburden and the entire bed of the ore have to be blasted. This is done by large-scale blasting of horizontal bore holes 20 ft. long, drilled in the toe of the bench 6.5 ft. apart. Drilling is done with the same kind of hammer and steel as used underground, but with 4-pt. detachable carbide bits of 2.36-in. gage. To guarantee the removal of sludge, an additional ¾-in. water pipe is inserted in the hole. All experiments in drilling vertical holes failed, the procedure with the present equipment and method being the only one that has proved economic. Results obtained are:

Rock broken per ft. of hole, 2.98 cu. yd. or 5.73 tons.
Explosives used, 0.245 lb. per cu. yd., or 0.128 lb. per ton.
Life of insert, 377 ft.

In the present small operation the current drilling practice is satisfactory. Another method will have to be used for future large-scale work. The ore is loaded by a shovel into 10-ton cars which are hauled to the mill on 35.43-in. gage track.

In the deep zone of the deposit, a typical section shows the following:

Overburden, 131 ft.
Ore thickness, 98-164 ft.
Depth of Devonian below surface, 230-295 ft.

One of the problems to be solved by the present underground development work is to determine what mining method can be used. The method will have to meet the following requirements:

1. It has to be applied over a wide area and at least 98.4 ft. of thickness.

2. It must be low-cost because of the low grade of the ore.

3. It must give a high extraction despite the low grade of the ore. Inasmuch as the metal content is distributed almost uniformly hori-

zontally and vertically, no selective method or method applied to a particular horizon is possible.

4. It must be safe. The rock does not permit use of wide and high openings.

For these reasons, only a mining method such as block caving can be considered if the deposit is to be worked by an underground operation. However, although the rock slabs off frequently, it is not likely to break up completely by itself. The main haulageways and the raise system would have to be in the underlying Devonian. This would necessitate continuous disposal of waste and involve high maintenance costs because of the bad qualities of the Devonian near the contact.

In spite of the considerable thickness and hardness of the overburden therefore, the following considerations suggest use of the open-pit method for the deep zone also:

1. Open-pit operation will permit high concentration and efficient supervision.

2. Ratio of overburden to ore is almost uniform.

3. High extraction will be possible.

4. The number of men required will be relatively small.

5. Miners trained for underground work are lacking.

Large-scale open-pit operation, however, calls for a huge investment. The final decision, therefore, must await further consideration of all the factors involved.

Flowsheet Worked Out

4. The Pilot Mill. It appearing to be wise to erect a pilot plant before proceeding further, a 400-ton pilot mill was put in operation in May, 1949, to work out an adequate ore-dressing method (see flowsheet). No doubt existed as to the feasibility of using flotation. While there were difficulties in floating the ore from the outcrop because of its oxidation, all ore below a certain depth of overburden is sulphide and amenable to flotation.

The chief problem in the mill is the crushing and grinding. For this the following two principles had to be kept in mind:

1. Inasmuch as the bulk of the ore is conglomerate, a way of crushing selectively had to be found to disintegrate the sandstone and the sandy cement between the pebbles in order to free the ore minerals, at the same time leaving the practically barren pebbles as large as possible. Picking by hand cannot be used because it is ineffective. Sink-float tests failed because a good part of the pebbles have the same specific weight as the mineralized sandstone.

2. Because the minerals are in the spaces between the sand grains, there is no need to grind these grains themselves if the connection between them can be loosened. To avoid unnecessary wear therefore ball-milling was rejected.

The procedure adopted and developed by Dipl. Ing. G. Rehwald (see flowsheet) is: Drying the ore in a drying drum to almost zero moisture, followed by breaking it in a series of impeller breakers and separating the coarse material (fractured pebbles and sand grains) from the fines by air separation. The fines, minus 0.0078 in., containing the ore minerals are given to flotation, and the coarse grains and sand, amounting to 70% of the total feed, are rejected as waste or used for building material or road surfacing. All units are connected with a dust-collecting system.

The primary crusher is a 19.7x39.4-in. jaw breaker. As its opening is not wide enough to take run-of-mine ore handled by a 2.6-cu. yd. shovel, excessive secondary blasting has to be done in the pit. To avoid this, the jaw crusher is to be replaced by a newly-built impeller breaker (Hazemag-prallmuehle AP-5) having an opening 39.4x59.1 in. in size.

Second-stage grinding is done in the same type of impeller breaker but one of smaller size (AP-3). This type of machine consists of a breaking chamber with one whirling impeller which has a series of interchangeable breaking bars. Speed of revolution is about 98.4 ft. per second, but, for fine grinding, can be brought up to 232 fps. Rock falling on the impeller is hurled against steel breaker plates, some of which are adjustable. Additional breaking is effected by collision of the fragments. The capacity of this type of breaker, compared with other machines of the same size, is astonishing—about 50 tph. for the smaller type and 150 to 200 tph. for the large type. The feed must be steady. The major problem is to devise a fast and reliable way of turning and changing the impeller bars, made of 14% manganese steel. Wear amounts to about 0.11-0.132 lb. per ton, the electric power necessary being 1 to 1.2 hp. per ton.

A second type of mill is used for fine grinding. Instead of an impeller it has a whirling disk, bearing on one side six bars cut from normal rectangular steel and welded to the disk. They rotate at 164 fps. Feed enters through the front bonnet to the center of the disk and is hurled by the bars against radially-mounted plates in the upper half of the chamber. The disk itself can be re-used about 10 times, whereas the bars have to be renewed after grinding 150 tons.

Preliminary tests having shown that ore with 5-7% moisture is likely to jam the disk breakers, it was decided to dry it. Operation of the pilot plant, however, has shown that both of the breakers described, after much experiment and chance, can now grind the run-of-mine ore without drying.

When some screens of satisfactory durability are found, air separation will be wholly replaced by wet-screening and the drying abandoned.

All other processes in the pilot plant are routine. Results are:

Lead concentrate, 75-80% Pb.; 1-2% Zn.

Zinc concentrate, 1-3% Pb.; 46-52% Zn.

Flotation tailings, 0.10% Pb.; 0.25% Zn.

Coarse tailings, after screening, 0.20% Pb.; 0.30% Zn.

The flotation tailings have to be pumped to a pond 6,560 ft. distant and 164 ft. higher than the flotation plant. Concentrates are hauled by truck over 6.2 miles to the railroad station and sent to the company's smelters.

5. Further Exploration. The activity so far described is confined to the relatively small Horm section of the concession. Knowledge as to the area beyond this section and the borders of the concessions is essential. Preliminary prospecting having shown good results, a new drilling program is under way, using modern equipment and a newly-developed core barrel.

Outlook Promising

Maubacher Bleiberg belongs to the most promising metal mining enterprises of Germany if one may judge from the figures given and what is known of the geological conditions. Large-scale operation is essential. Present hopes are to develop the mine and to build a plant of 3,000 tons daily capacity to give a yearly production of 20,000 tons of lead and 8,000 tons of zinc.

KEEPING TAB ON PRACTICE

Variations in Block Caving. Block caving and numerous adaptations of it are being continued by Cleveland-Cliffs Iron Co. on the Marquette range, with grizzly drifts becoming less popular in favor of the method of caving directly to the transfer drifts. Side-wall cutting has now been eliminated, along with undercutting the block by dog drifts. It is now known that the blocks cave satisfactorily and practically vertically without cutting off the sides. The long-hole system of undercutting is proving satisfactory.

Tipped Steel Helps Cut Holes. A Canadian operator finds that use of locally-tipped steel in drilling large-diameter cut holes increases the length of the round in soft ground.

Quebec Mine To Try Diesel Locomotive. A 10-ton Hudwood-Hudswell diesel locomotive has been bought recently by one of the Quebec gold mining companies. Dimensions are 5 ft. 3 in. height, 3 ft. 4 in. width, and 13 ft. 9 in. length over buffer beams. It has a 3-ft. 9-in. wheel base and will negotiate curves of 30-ft. radius. The power unit is a 4-cylinder Gardner oil engine of the cycle injection type, developing 68 b.hp. at 1,700 rpm. when using light diesel fuel oil. An air filter, said to be effective, is fitted to the induction manifold. Fuel consumption, in builder's tests, appears to be 0.395 lb/b.hp.-hr. at ¼ load and 0.365 lb. at ¾ load.

Air Locomotives for Filling, in Stopes. Bunker Hill & Sullivan, Idaho, is finding standard air-line pressure locomotives and small cars valuable for filling stopes, where the distance is uneconomic for slushing or where it would be necessary to "double-slush," according to R. S. Hooper. Use of 18-in. gage mine track of very light cross section permits such use in square set stopes to good advantage.

Mine Diesel Locomotive for Quick Transfer. Compactness for its power and weight without loss of accessibility to engine, transmission, electrical system or running gear is said to characterize a newly designed diesel mine locomotive supplied by Hunslet Africa (Pty.) Ltd., Cleveland, Transvaal, to a gold mine on the West Rand, South Africa, for service in development headings. Length over buffer beams is 7 ft., overall width 3 ft. 1 in. (gage 2 ft.), and height above rail 4 ft. 6½ in. With these dimensions it is said to be readily transferable from level to level. Power is supplied by a two-cylinder Gardner LW diesel engine with 4½-in. bore and 6-in. stroke, which develops 34 b.hp. at 1,700 rpm. Exhaust gases are passed through a conditioner.

Tipped Steel at Great Bear. Light air-leg-mounted drills used with carbide-tipped steel have found favor with Eldorado Mining and Refining (1944) Limited, at both the Port Radium and Beaverlodge operations, according to E. B. Gillanders, manager of mining and exploration. At the former, 27 such units are in service, doing 90% of all drilling, and 14 at Beaverlodge, where they are used 100%, all in sinking and lateral development. The machine used at both mines is interchangeable as a plugger, as a drifter with a jack leg, or as a stoper with a stoper leg. Weights are added when it is used for sinking, thereby cutting down vibration and increasing rod life. This interchangeability saves time and lessens the equipment required. Longer rounds result from the increased flexibility and faster drilling speed. The smaller diameter holes drilled have raised the efficiency in use of powder and cut its consumption.

Cost with the new equipment is given by Mr. Gillanders as 5.06c. per ft., compared with 9.25c. per ft. using the old equipment and single-pass steel bits.

Over five months, according to H. E. Lake, mine captain, average footage per rod at Port Radium was 516 ft. and the maximum 1,170 ft. Performance at Beaverlodge is slightly better.

Training of men to break better rounds than they did with the other equipment has been easy. To encourage better performance the company has changed its contract system whereby a man is paid at an enhanced rate for each 6 in. increase in performance.

A small increase in rod life has been obtained through grinding carefully, so as not to grind away more of the insert than necessary, and to get a proper contour of the insert so that it will cut well and not break, according to Mr. Lake. A new 5-ft. rod is issued at the same time as a new 7-ft. rod, to prevent a new rod from being run in the hole after one partially worn, thereby causing the insert to chip.

Quick Delays for Diamond-Drill Stoping. Stoping, using parallel BX diamond-drill holes and milli-second delay detonators, is proceeding satisfactorily at the property of the Rhokana Corp., Northern Rhodesia. In eary experiments with this type of drilling, blasting was done with instantaneous Cordtex. Results were not encouraging, fragmentation was poor, and effects of concussion on the hanging wall and along the strike of the orebody far outweighed any advantages. With milli-second delay detonators, however, fragmentation improved, effects of concussion have been negligible, and primary blasting costs have been reduced about 25% below the normal for EX stoping. Holes up to 60 ft. long are customarily drilled, both upwards and downwards.

An average of 5 tons of ore is broken per foot drilled, against 2 tons per foot with EX drilling. Footage per machine-shift, however, has decreased about 20%. Combined, these figures show 120 tons broken per machine-shift with EX drilling and 180 tons with BX drilling and milli-second delay detonators, an increase of 50%.

Bits by the Million. Latest word from South Africa is that 72,000,000 single-use, or throwaway-type, steel bits are being used annually in the country's gold mines.

Dominant Trends in Drilling Practice. The rapid growth witnessed in the use of the airleg-light drill combination is illustrated by figures quoted from a letter by A. T. Holman, Holman Bros.' managing director, England. In 1947, they placed 360 of their airleg combination; in 1948, 470; in 1949, 944; and in 1950, 2,013. Enlarging on the subject, Mr. Holman points out that two tendencies in rock drill application, already apparent in 1948 and '49, have become dominant and bid fair to become universal. These are, in both cases, to ease the miner's job (1) by providing a support for smaller drills up to 2¾-in cylinder diameter, and (2) by improving the supports for the larger drills —the drifters. The light combination is displacing the larger drifters in many places, due to its high proportion of drilling time to over-all working time. It will drill holes at any angle, to any depth and up to a horizontal height of 10 ft. Air consumption and over-all cost are about half that of drifter equipment.

Improvement in supports for drifters has followed in the use of power-operated long cradles with centralized controls and mounted on hydraulically-operated drill rigs.

We Mobilize for Freedom

WHY Controls are Necessary

One of the encouraging characteristics of the American people is their dislike for government controls. This augurs well for the future of their economic and political freedom.

But for the next few years we must not only tolerate but also help to make effective a whole battery of emergency government controls over our economic life. If we fail to do this now the future of that freedom we cherish will be imperilled. It is the purpose of this editorial—the third in a special series—to explain in simple terms why this is so.

After our military victory in World War II, we rushed through a demobilization which cut our military strength to about one-tenth of its wartime peak. Our allies did much the same thing. But the Russians maintained much of their wartime military strength and built up that of their satellites. With prodigious speed we switched from military to civilian production and went on to enjoy a rousing postwar boom—the greatest in our history.

This boom was in vigorous progress when, on June 25 last year, the Russian-sponsored North Korean army attacked South Korea. Our industrial production was rolling along at almost twice its prewar level. We had labor shortages in many key industrial areas. Under the impact of heavy buying all along the line, prices were climbing.

When the North Koreans smashed into South Korea they smashed into our national consciousness this fact: if we want a fair chance to save our national freedom from destruction by Communist aggression, we must race to restore some of the military power we had so speedily written off after World War II. And we must do it with our resources already very fully occupied with a boom in civilian business.

Program Small Compared to World War II

Compared with our military effort in World War II, the mobilization on which we are now embarked is small. At its peak, under present schedules, it will absorb no more than one-fifth of the total national production. During World War II we reached a point when nearly half of our total production went for war-making.

Moreover, our economy now is much bigger and stronger than it was in World War II. During the last decade there has been an increase of about 15 percent in our labor force. Our workers have had the training advantage of steady employment. The capacity of our industrial establishment is two-thirds again as great as it was ten years ago. Since the war no less than $70 billion has been spent to expand and modernize it.

Given time, the industrial giant we have created could pick up in its stride the added load of production for defense that now is con-

templated. But speed is of the very essence. There is little dissent from the proposition that if we are to stand off Russian aggression successfully we have, at the outside, two years in which to get ready.

Controls Needed to Prevent Chaos

These two facts – (1) the necessity for speed in our rearmament program and (2) an economy already stretched taut by a record civilian boom–create the general necessity for government controls. If we simply pile the billions of added defense expenditures authorized since last June on top of the civilian boom, and let it go at that, two destructive developments would follow. There would be a scramble for scarce materials, notably metals, which would create chaos in those markets. And prices would go through the roof.

Our situation during this mobilization is radically different from what it was when we rushed to get ready for World War II. Then we started with an economy that was coming out of a long depression. There was plenty of slack. Even in mid-1941 we still had over 6 million unemployed. Thus it was possible for us to expand war production greatly and also increase civilian living standards before the limits of our productive capacity made extensive controls necessary. But as we begin this new mobilization we find our economy already operating virtually at capacity. This fact is of key importance in understanding why this relatively small defense program so quickly requires the imposition of controls.

The selection and administration of controls thus far has been badly bungled. The threat of price controls, for example, was broadcast so vigorously and for so long that our people were virtually asked to raise prices and thereby do much to defeat the controls. Adequate taxation directed so as to attack inflation at the source and thus give direct price control a chance to operate has not yet been provided.

Indeed, we could readily assemble a long and devastating catalog of the deficiencies of the government's control program. But that would not dispose of the necessity for controls – by priority, by allocation, and, as a stop-gap, by direct prescription of selling prices – if we are to carry out our mobilization successfully. That is the only means by which a clear right of way for defense production can be cut through the highways of trade and commerce now jammed with civilian boom business.

Hope In The Wilson Plan

Since he became Director of Mobilization, Charles E. Wilson has added a new element of order and hopefulness to the mobilization program. He has laid out a plan which, if we are spared all-out war, would do three things by 1953. First, it would produce the weapons needed by our army and our allies to meet an immediate threat. Second, it would create the capacity that would enable us to move at high speed into weapons production for all-out war – if necessary. Third, it would create the additional production capacity that would restore by that date our ability to resume the climb of the American civilian standard of living.

In technical and industrial terms the Wilson Plan seems to be feasible. If it is successfully carried out, we should be able to begin getting rid of controls rapidly by 1953. But to carry out the program successfully, it must now have vigorous support from everyone. That does not mean mere agreement that it is a good plan. It means that we must conform to the controls that are necessary to make the plan work. In developing this support, the business community is in position to exercise crucially important leadership.

As has often happened in our national history, we are confronted by a paradox. We must accept emergency controls for the time being to insure survival of the freedom that they infringe. But, as we do this, we may find some comfort in the reflection that while controls from Washington are hateful, controls from Moscow would be infinitely worse.

McGraw-Hill Publishing Company, Inc.

MARKETS—Trends and Prices *(Continued from page 69)*

U. S. Slab Zinc Statistics

(American Zinc Institute)

Slab zinc production, shipments, stocks and unfilled orders of smelters operating in the United States, figures in tons:

1950	Production	Shipments: Domestic	Shipments: Export (a)	Shipments: Gov't Acct.	Shipments: Total	Stock at End	Unfilled Orders
January	69,948	69,020	402	12,710	82,132	82,037	52,941
February	69,639	72,843	768	10,646	84,257	67,419	45,131
March	77,946	74,700	627	10,262	85,589	59,776	55,433
April	75,877	73,389	397	9,347	83,133	52,520	56,304
May	79,645	71,101	209	19,036	90,346	41,819	66,430
June	75,766	68,214	422	22,284	90,920	26,665	65,361
July	77,868	67,119	371	16,626	84,116	20,417	67,463
August	73,399	69,073	2,893	7,399	79,365	14,451	76,847
September	71,057	70,656	2,580	2,005	75,241	10,267	69,062
October	79,997	71,596	4,277	5,283	81,156	9,108	64,436
November	79,226	69,202	3,702	6,175	79,079	9,255	60,799
December	79,986	72,333	1,541	6,483	80,357	8,884	74,795
Totals	910,354	849,246	18,189	128,256	995,691	.....	.....
1951							
January	80,937	72,068	3,156	4,385	79,609	10,212	72,770
February	70,285	64,784	2,316	2,280	69,380	11,117	76,446
March	80,450	70,845	5,916	3,701	80,462	11,105	80,769
April	77,813	69,113	2,473	2,821	74,407	14,511	77,293

(a) Includes drawback.

Official London Prices

Excepting copper, which advanced £24 per long ton on May 25th, prices named by the Ministry of Supply were unchanged. Delivered prices prevailing in the U. K. as May ended were as follows:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	234	0	0
Fire refined, high conductivity	234	0	0
Fire refined, high grade	233	10	0
Fire refined, min. 99.7 percent	233	0	0
Fire refined, min. 99.2 percent	232	10	0
LEAD:			
Soft, foreign duty paid	160	0	0
Soft, Empire	160	0	0
English, refined	161	10	0
ZINC:			
Foreign (G.o.b.) duty paid	160	0	0
Domestic (G.o.b.) duty paid	160	0	0
Prime Western and debased	160	0	0
Refined and electrolytic	164	0	0
Minimum 99.99 percent	166	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

May 31, 1951

Aluminum, ingot, 99 plus percent, lb. (base price)	19c.
Antimony, spot, lb., 5 tons and up but less than carload in cases	45.300
Bismuth, ton lots, lb.	$2.25
Cadmium, commercial sticks, delivered, lb.	$2.55
Calcium, lb., ton lots, 98 percent, cast	$2.05
Chromium, 97 percent grade, lb., contract	$1.07
Cobalt, 97 to 99 percent, per lb.	$2.10
Indium, troy oz.	$2.25
Nickel, cathodes, lb., f.o.b. Port Colborne (a)	50½c.
Magnesium, 99.8 percent, carloads, lb., producer's plant, Freeport, Texas	24½c.
Palladium, troy oz.	$24.00
Platimum (Official quotation wholesale lots) troy oz.	$90.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$212 @ $215
Selenium, 99.5 percent, lb.	$3.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75
Thallium, 100 lb. or more, lb.	$12.50
Titanium, 96 to 98 percent, lb.	$5.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, imported, 10 to 12% BeO, per unit	$28.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
44% Cr_2O_3, no ratio	$27.00 @ $28.00
48% Cr_2O_3, 3 to 1 ratio	$43.00 @ $50.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$8.70
Mesabi bessemer	$8.45
Mesabi, non-bessemer	$8.30
Lead (Galena), 80 percent, Joplin, Mo., ton	$218.42

Manganese Ore—Per long ton unit of Mn basis 48 percent manganese, nearby positions, subject to premiums and penalties, $1.05 @ $1.10., c.i.f. U. S. ports, duty extra. Long-term contract quotations wholly nominal and matter for negotiation.

Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	66..
Tantalite, 60% concentrate, per lb.	$2.00 @ $2.50
Tungsten Ore, per unit of WO_3	
Foreign, 60 percent, U. S. equivalent, duty extra	$65.00 @ $67.50
Domestic, scheelite, 60 percent f.o.b. mine	$65.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	31c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$115.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl. carload lots delivered	6½c.
Cobalt Oxide, 72%, metallurgical grade, per lb. of Co	$2.25
Copper Sulphate, 100 lb.	$8.95

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of alloy, 5 lb. ingot	$1.56
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	21¾c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$185.00
Ferromolybdenum, 55 to 65 percent Mo. lb. of Mo. contained	$1.32
Ferrosilicon, 50 percent, per lb. of contained Si	12.4c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$5.00
Ferrovanadium, per lb. of V delivered	$3.00 @ $3.25
Silicomanganese, max. 1½ percent carbon, per lb. contracts	9.9c.
Spiegeleisen, per long ton, 19 @ 21 percent grade	$75.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960 @ $1,500
Crude No. 2	$595 @ $900
Spinning fibers	$275 @ $475
Shingle fibers	$123 @ $170
Paper stock	$85 @ $119
Waste	$63 @ $70
Shorts	$30 @ $63
Asbestos, Vermont, f.o.b. Hyde Park:	
Spinning fibers	$254.10 @ $274.45
Shingle stock	$122.65 @ $148.50
Paper stock	$86.90 @ $106.15
Waste, stucco or plaster	$64.90
Rug or shorts	$31.20 @ $57.60
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$13.00 @ $13.50
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.25 @ $9.50
Bauxite, long ton, f.o.b. point of shipment:	
Domestic, crude, 50 to 52 percent (not dried)	(a) $4.50 @ $5.50
Domestic, chemical, 55 to 58 percent	(a) $8.50 @ $9.50
Domestic, abrasive, 80 to 84 percent	(a) $18.00 @ $18.50
China Clay, f.o.b. mines, ton:	
Georgia, filler and ceramic grades	$8.50 @ $9.50
North Carolina ceramic grade	$20.25 @ $22.25
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50 @ $22.25
Glass feldspar, white, 20 mesh	$11.75 @ $12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois, 70% effective, CaF_2, ton	$43.00
Acid 97% conceatrate, bulk, ton	$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00 @ $14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington	$36.30

Mica—Domestic, f.o.b. mines. Punch 12 to 22c. per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 80 to 85c.; 2 x 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 nch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap, $32 and up.

Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	(a) 12 @ 14c.
Sulphur, Texas, mines, long ton	$22.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50 @ $20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$30.00

(a) Nominal.

IRON AND STEEL

Pig iron, gross ton, basic, Valley furnaces	$52.00
Steel, f.o.b., Pittsburgh billets, net ton	$56.00
Structural shapes, 100 lb.	$3.65

WASHINGTON IMPACT

War Or Peace Is Controlling Issue Behind Most Government Difficulties

IT'S A LONG JUMP mentally from a piece of American roundsteak to Iranian oil, but it's one that thoughtful people in Washington are trying to make. The anger of the meat industry over price roll-backs is spearheading the fight against renewal of the Government's powers to control prices, wages, rent and credit. As many powerful business interests line up with the meat producers against controls and the Administration rallies business men, temporarily in Government jobs, to speak up for controls, it becomes more and more apparent that underlying the dispute is a difference of opinion as to the possibility of war. That's where the crisis in Iran bobs up to plague policy-makers and law-makers.

The truth is, the arguments for ending or relaxing controls would have only a fraction of their present force if the world situation were to turn worse in some dramatic and forceful manner. And the opposite is just as true.

The fact that the possibility of war is the underlying issue is easily forgotten. The headlines go to the angry disputants on both sides, even to such threadbare statements as that of President Truman warning solemnly against un-named "selfish interests" who oppose controls. Calm appraisal of the world situation, which would make it possible to raise the discussion to the level that it deserves, is hard to find.

The businessmen who came to Washington to take responsible positions in the mobilization effort did so because they thought the world situation was so dangerous that a great effort was needed to assure our security. When men like Charles E. Wilson, the mobilization director, Edward Gibson, Defense Production administrator, and Manly Fleischmann, NPA administration, line up now for a continuation of controls, it can mean only one thing: They think the threat of war justifies their stand. And when business groups, after careful deliberation, line up on the opposite side, what they are really saying is that the present threat of war is not acute enough to make controls useful or necessary.

A little story about the decision to start the Controlled Materials Plan on July 1 highlights the role of the war threat. During the weeks immediately preceding the announcement of CMP, the need for such a detailed and burdensome control over industry was seriously challenged. Manly Fleischmann invited top executives of nine big companies, deeply involved in the mobilization effort, to come to Washington to discuss CMP. Seven of the nine immediately recommended that CMP be put into effect. The others argued that the present and contemplated demands of the military were not great enough to justify imposing complete controls on all users of steel, copper, and aluminum —the controlled materials. Fleischmann didn't argue the point. He simply pointed out that the CMP had been six months in preparation, that it would be three more months in a trial run, and three more months before it was operating efficiently. In the present world situation, could we afford to delay a plan which would be clearly essential in case of outright war? That was the issue as it appeared to Fleischmann. Before the meeting was over, opinion of the group was unanimous that CMP should be put into effect.

In the case of CMP, the alternative would have been a simple one. Direct military needs are going to run only about 15% of steel supplies. Let the military get what it needs on a simple priority system, and tell everyone else to scramble for what they need. With steel and aluminum output going up, we'd soon be in balance. This was the argument that held up the announcement of CMP several weeks beyond the originally scheduled date. It was the threat of war which tipped the scales.

Machinery Allocation Is Shifted to NPA

HERE IS WHAT was behind the transfer of mining machinery allocations from Defense Minerals Administration to the National Production Authority.

The men running the Controlled Materials Plan do not want any "czars" operating in any segment of industry this time, as they did in World War II. Such "czars" were both claimant agency and allocating authority for their industry.

There were no complaints about the way Harold Montag was running the Requirements Division of DMA. His transfer to NPA proves that. But the top CMP executives insisted that the authority to allocate machinery be taken out of DMA, which is the claimant agency for the mining industry. They viewed NPA's original grant of allocations authority to DMA as a mistake which had to be corrected before CMP got underway. Incidentally, it was the only case of its kind in the mobilization set-up; in no other case had NPA delegated authority.

Technically, DMA has merely returned to NPA authority which NPA surrendered earlier. Montag will be head of a Mining Machinery Division in the Industrial and Agricultural Equipment Bureau. Leslie M. Case, who was chief of DMA's Mining Machinery Branch, made the shift to NPA with Montag. DMA retains its role as claimant agency for the mining industry.

The role of Montag and Case in NPA will be to distribute mining machinery allocations, within the amounts specified for the industry. by the Requirements Committee. DMA and the Defense Solid Fuels Administration will knock on their door on behalf of domestic mining needs. The Office of International Trade and the Economic Cooperation Administration will be claimant agencies for export needs.

Subsidy Plan Developed For Zinc Mining

DMA, with strong support from an influential segment of the zinc industry, has developed a subsidy plan for zinc mining which is similar to the Premium Price Plan as the latter was originally launched.

The new scheme calls for a four-cent premium to be paid to domestic mines for production in excess of a base-period level. However, all zinc production from mines producing less than 500 tons per year of copper, lead and zinc, combined, would be considered as "new." The plan contemplates a two-years duration and is on a per-mine basis. DMA estimates that it would produce 100,000 tons per year of added zinc production at a cost of $8,000,000 per year. Payments are to be monthly through smelters and custom mills on zinc content.

New Metals And Minerals Bureau To Have Key Role

THE KEY ROLE of minerals in mobilization was highlighted by still another reorganization move in preparation for CMP. A Metals and Minerals Bureau was established, consisting of the Iron and Steel, Copper, Aluminum and Magnesium, Tin, Lead and Zinc, and Miscellaneous Metals and Minerals Division of NPA. The bureau head is Norman W. Foy, on leave

from his position as general manager of sales for Republic Steel Corporation. He was director of the Steel Division of WPB during World War II.

The metals and minerals divisions have one of the key functions under CMP. They are charged with reporting on the availability of supplies. They must make their studies, and submit their reports, to the Requirements Committee of DPA before the pie is cut. In effect, they determine the size of the pie.

Price Cuts Are Possible For Mining Machinery

FAIRLY GENERAL, though moderate, roll-backs in the prices of some items of mining machinery are in prospect.

They will be the first concrete results of ceiling price regulation No. 30, the over-all machinery order issued last month by the Office of Price Stabilization.

Of course, it is still too early to gauge the order's impact with any precision. It is only just now going into force; the effective date was May 28, and in many cases, even later.

But the first of the required forms that are beginning to trickle in from machinery-makers show very few price increases; in most cases, the formula prescribed by CPR-30 producers roll-backs varying in amount with the product and the price changes imposed since Korea.

CPR-30 permits machine-makers to add increases in factory, payroll, and material costs to pre-Korean prices in effect during the optional base period, either April 1, through June 24, 1950, or any one of the three previous calendar quarters.

The order covers, specifically;

Natural and artificial abrasives, cable and belting, flanged-wheel mining cars, coal preparation equipment, core-drilling and core-making machinery, cutting tools, elevators, dredging, excavating and earth-moving equipment, quarrying machinery, pumps, and stationary plants.

Exempt are used machinery and rental equipment.

Brief, But Important

TUNGSTEN FLOOR PRICE—guaranteed five-year price for tungsten in concentrates (E&MJ, May, p. 104) has been revised to cover all production of qualified producers, not simply increases in production.

LEAD-ZINC TARIFF—Industry has indicated willingness to have tariff removed, subject to reinstatement if price drops, as is now law for copper. Legislation will follow.

TORQUAY CUTS — Lead producers were both surprised and dismayed at lead's being included in tariff cuts at Torquay (see Markets). Their inside information had been to contrary.

LABOR THIS MONTH

Joseph M. Gambatese, McGraw-Hill Washington News Bureau

MANPOWER INCENTIVE: Copper, lead and zinc mines with highest productivity will get first call on available miners—if they need them. Classification list, like one used in World War II, is being prepared by Defense Minerals Administration to channel miners to most productive mines, thus assuring maximum metal output.

PRODUCTIVITY: Mines with highest tonnage of recoverable ore per miner will head the classification list. You derive index by dividing average monthly employment into recovered tonnage. For example, mine employing 1,000 and producing 5,475 tons has index of 5.48 (or productivity of 5.48 tons per man per month). Monthly averages will be based on average over six months. List won't be used until early next year.

DATA: Unlike World War II, Bureau of Mines will collect all the information, making it available to DMA. DMA feels this will be an improvement, permit quicker attention to turnover and manpower requirements problems.

DMA READY TO HELP: DMA says to bring your problems in before it gets to critical stage. Then planning might avoid crisis.

TRAINING: You can get, free, a technical lecture on industrial training in mining prepared by Kennecott's Howard B. Gunderson. It's the story of the Kennecott training program. Just write U. S. Dept. of Labor, Bureau of Apprenticeship, Washington 25, D. C. Ask for: "Training at the Utah Copper Division, Kennecott Copper Corporation."

OVERTIME STAYS: Disregard any talk you hear about suspension of time-and-a-half overtime for the duration of the emergency. There's no chance of it.

WSB UNDER ATTACK: House Labor Committee wants the Wage Stabilization Board to justify loose wage policies and disputes functions. WSB will get backing from the Senate committee. Little will come of fuss in Congress. Look for few important changes either in wage or disputes authority.

WAGE POLICIES: They will continue loose until — and unless — Congress demands tightening, to check living-cost rise. Nothing will stop sixth-round increase of about 10 cents an hour.

LABOR DISPUTES: No compulsory board like the War Labor Board is contemplated. WSB Chairman Taylor prefers voluntary steps unless we get into war. WSB has no authority to stick its nose in any dispute. It can only hear a case, and make "recommendations," (1) if both sides ask for it, or (2) if the President certifies the dispute as one having a substantial effect on national defense.

NO NO-STRIKE PLEDGE: Labor won't give it; industry and Government won't ask for it. Industry feels the price would be too high: suspending Taft-Hartley.

THAT 30-CENT DEMAND: Mine, Mill and Smelter Workers' wage goal moved farther away when the left-wing pacesetter, United Electrical Workers, settled with General Electric for 9 cents. UE threatened to strike for 32 cents. Mine-Mill claims a 30-cent victory at Canada Cement, Ltd. But it settled for 10 cents with Precision Scientific in Chicago.

ANACONDA: BLS survey of 188 major union contracts covering 5,000 or more employees lists only one in non-ferrous metals: Anaconda Copper at Butte. Contract covers 5,000; expires in June.

FOLLOWS UE: Mine-Mill echoes the left-wing UE. Besides raising almost the same wage demand, it has picked up the UE's attack on the BLS consumer price index, on the United Labor Policy Committee and on Labor's cooperation with Mobilization.

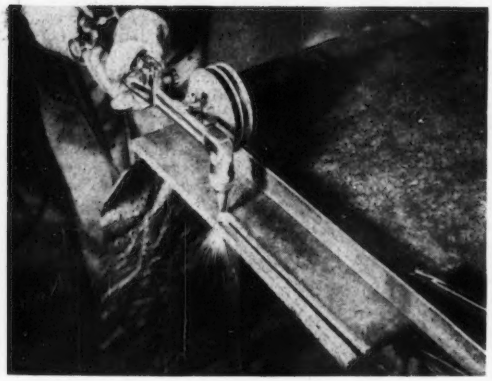
CIO RAIDS BLOCKED: Mine-Mill smashed three attempts of the CIO Steel Workers to take over bargaining rights. Mine-Mill won 186-67 at A.S.&R.'s East Helena (Mont.) smelter and 775-154 at the Tacoma smelter. At Anaconda Copper at Great Falls, Mont., Mine-Mill won by 724-287. Other elections have been ordered by NLRB at Kennecott's Arthur and Magna mills, near Garfield, Utah. Mine-Mill claims the CIO has spent $250,000 on raids.

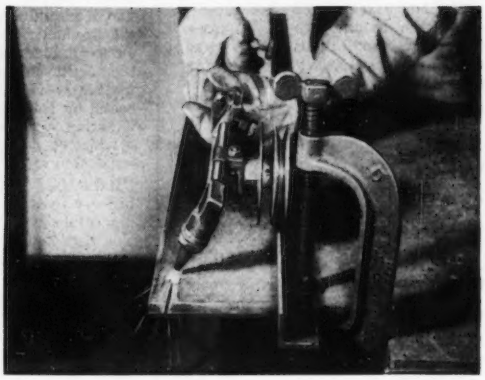
COMMIES: NLRB says you can't help get rid of communist-led union —even for patriotic reasons—by helping a non-communist union take over. That's unfair. (Stewart-Warner case)

The Supreme Court holds AFL and CIO officers must sign non-Communist affidavits if there affiliates want to use Taft-Hartley law. (Highland Park decision)

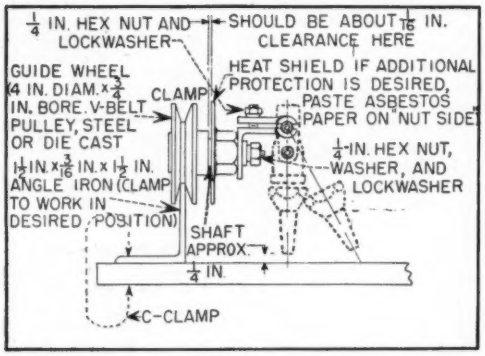
Must you bargain with a non-complying union? Supreme Court may decide in West Texas Utilities case. Lower court says: non-compliance doesn't relieve you of obligation to bargain, even though NLRB can't issue complaint of unfair practice.

OPERATING IDEAS





Guide for Straight-Line Cutting

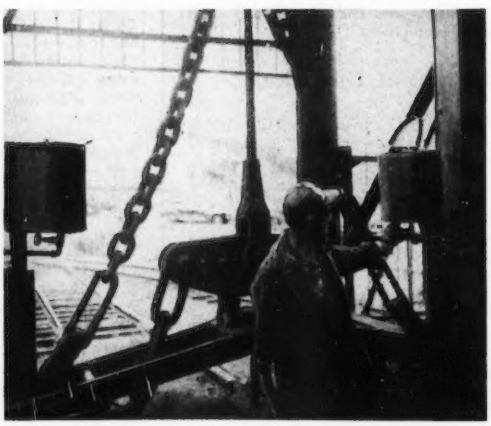

1/4 IN. HEX NUT AND LOCKWASHER
SHOULD BE ABOUT 1/16 IN. CLEARANCE HERE
GUIDE WHEEL (4 IN. DIAM. x 3/4 IN. BORE. V-BELT PULLEY, STEEL OR DIE CAST
CLAMP
HEAT SHIELD IF ADDITIONAL PROTECTION IS DESIRED, PASTE ASBESTOS PAPER ON NUT SIDE
1/4-IN. HEX NUT, WASHER, AND LOCKWASHER
1 1/2 IN. x 3/16 IN. x 1 1/2 IN. ANGLE IRON (CLAMP TO WORK IN DESIRED POSITION)
SHAFT APPROX.
1/4 IN.
C-CLAMP

Here is an easily-made shop-built cutting guide that will save time. It consists of a 4-in. V-belt pulley with a ¾-in. bore. This rotates on the unthreaded section of a ¾-in. machine bolt. A small clamp which holds the burner is attached to the end of the ¾-in. machine bolt by means of a length of threaded ¼-in. steel ⅝-in. long which is braze welded onto the end of the larger bolt as shown. (A hole ¼ in. deep is drilled into the end of the larger bolt before brazing.) The heat shield consists of a 1/16-in. steel plate, 4⅛ in. in dia., which is braze-welded to the ¾-in. hex. nut. As shown in the illustrations, this assembly can be used to burn beveled or right angle cuts simply by changing the position of the burner in the clamp. Illustrations, courtesy LINDE TIPS, April, 1951.

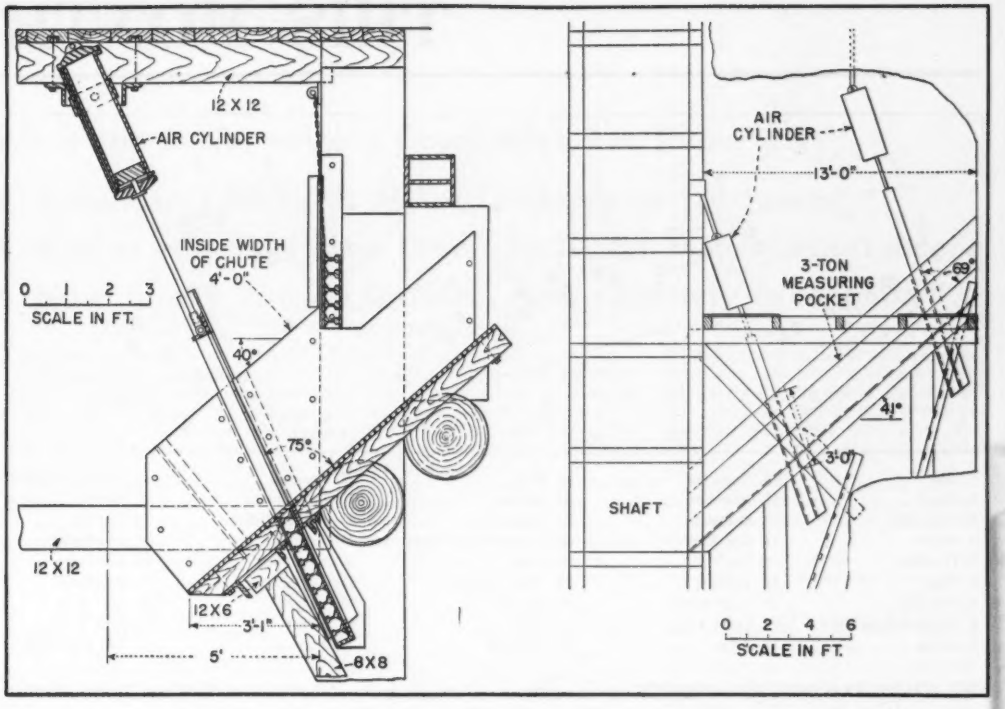
Automatic Oilers Lubricate Shaft Guides on Shift

Lubrication of shaft guides at Maryland No. 2 shaft, Berwind-White Coal Mining Co., Wilmore, Pa., is an automatic operation as the result of an applied idea of Norman Lehman, master mechanic. Mr. Lehman mounted two 7-gal. tanks, one for each side, at the top of each cage. A pipe from the bottom of each tank feeds oil to a guide and the cage runners spread the oil on the guide as the cage travels. Valves in the feed pipes control oil flow.

Previously, two men rode the top of the cage and manually applied the oil. Now, the valves are opened, oil flows during four regular trips of the cage, then the valves are closed. It is no longer necessary for men to ride the cage and the guides can be lubricated during working hours. The tanks require filling about once a week.



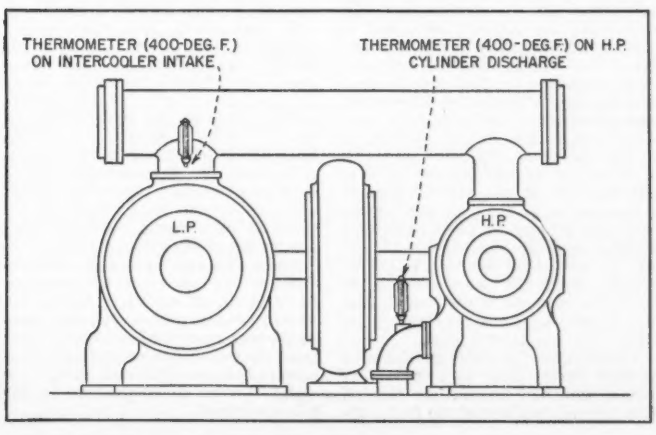
OIL TANKS mounted on the cage provide automatic guide lubrication during on-shift hoisting.



"Guillotine" Gate for Effective Loading

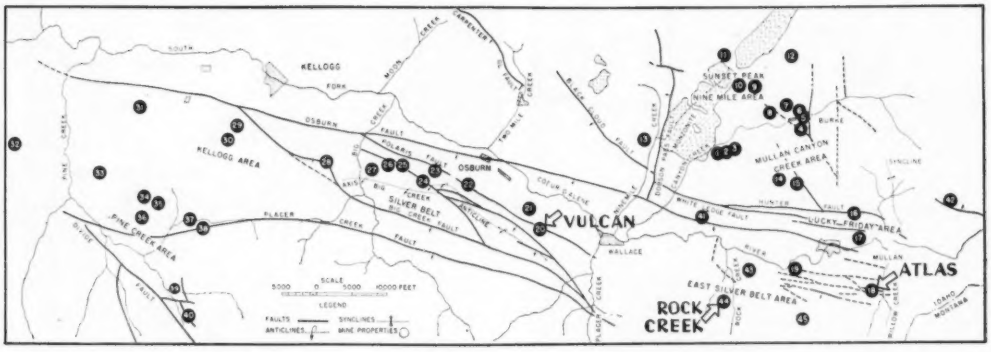
Members of the operating staff of the Climax Molybdenum Co., Climax, Colo., report that this type of "guillotine" loading gate has proved effective for loading skips and mine cars. Details of the gate are shown at left. Note that the gate is air operated, and that the stream of flowing muck is cut off by upward movement of the gate. The lower part of the gate which holds back the muck is reinforced by 9 cross rails. The installation at left was designed to load mine cars. If two "guillotine" gates are installed as shown at the right, an ordinary loading chute can be converted into a measuring pocket for loading skips. Staff members of Climax first noted this type of loading gate at Asbestos, Quebec.

Thermometers Indicate Valve Trouble



Phil Keast, master mechanic, Empire Star Mines Co., Ltd., Grass Valley, Calif., suggests the simple method shown, to keep a check on air compressor valves, thereby avoiding possible fires in the compressor or pipe because of a leaky valve. He has done this by installing two 400-deg. F. thermometers on each air compressor operating at the mine, one on the intercooler intake and the other on the discharge pipe on the high-pressure cylinder. A broken or leaky valve will cause a substantial rise in temperature. Thus the operator can immediately determine which cylinder contains a defective valve if he watches the thermometers. Temperature readings are recorded twice each shift to keep a close check on compressor valve conditions.

THIS MONTH



1. Gem
2. Frisco
3. Black Bear
4. Hecla
5. Poorman
6. Tiger
7. Sherman
8. Standard Mammoth
9. Custer
10. Tamarack
11. Interstate
12. Hercules
13. Day Rock
14. Star
15. Morning
16. Gold Hunter
17. Lucky Friday
18. Atlas
19. Moe
20. Vulcan
21. Argentine
22. Coeur d'Alene Mines
23. Nellie
24. Silver Summit
25. Chester
26. Polaris
27. Sunshine
28. Crescent
29. Last Chance
30. Bunker Hill
31. Page
32. Hypotheek
33. Liberal King
34. Denver
35. Sidney
36. Pittsburg
37. Nevada Stewart
38. Highland Surprise
39. Douglas
40. Constitution
41. Golconda
42. Snowstorm
43. Gem State
44. Rock Creek
45. East Silver Belt

THE ATLAS EXPLORATION PROJECT to be started jointly by Hecla, Newmont, and New Jersey Zinc marks the first deep-level probe for ore in the far eastern end of the productive Silver Belt of the Coeur d'Alene district. The recent Vulcan deep-level strike has also focussed attention to this area. See E&MJ, April 1951, P. 124

Atlas Project to Probe for Deep Ore in Idaho's Silver Belt

H. W. Ingalls
Mullan, Idaho

HECLA, NEWMONT, NEW JERSEY ZINC, AND ATLAS MINING companies have formed a new company in which the participants own a ¼ interest each, for the purpose of sinking the Atlas shaft in the East Silver Belt at Mullan from the 800 to the 2,400-ft. level as a prospecting venture. Interest in the Atlas is due in part to favorable developments in the 3,000-ft. shaft on the Vulcan property near Wallace, which has been financed by the American Smelting & Refining Co. and Day Mines, Inc. Two or three years ago Hecla sank a 3-compartment shaft on the Atlas to a depth of 800 ft. and drove a drift 1,000 ft. east paralleling the vein structure. Diamond-drill holes were driven to the vein at intervals, but results were not disclosed. At the bottom of the shaft, however, a crosscut to the vein opened about 4 ft. wide of low-grade galena ore and a wide zone of siderite iron slightly mineralized with chalcopyrite. At the east end of the drift work another crosscut to the vein opened about 8 ft. wide of mineralized zone matter containing galena, zinc and samples of gray copper. One sample assayed 8% lead, 0.9% copper and 18.9 oz. silver per ton.

Hecla abandoned the property because of taxes and high cost of labor and mining supplies. James F. McCarthy, deceased manager of Hecla, had planned to sink the shaft to the 1,600-ft. level. The present combined companies plan to prospect the vein system on the 2,400-ft. level and if no commercial grade ore is encountered they will go deeper, as all surface indications are favorable to large ore deposits. Atlas has an extra large iron capping and the lower Atlas tunnel shows a vein system containing bunches of commercial grade ore which were milled at the Hunter mill in Mullan. One of the cars of concentrates, milled at the Golconda custom mill and shipped to the AS&R East Helena smelter, assayed $54.17 per ton and netted the company $2,194.32. Further north the tunnel shows a 10-ft. wide vein of almost solid iron pyrite which has never been prospected by any lateral work.

Participation in Atlas development is New Jersey Zinc Co.'s initial entrance into the Coeur d'Alene district. The mineral holdings of the four companies cover a block of ground some 4 miles in length, extending from and including Hecla's Rock Creek property, about two miles west of Mullan, the Atlas and other groups two miles east to near the Montana state line. Work of sinking the Atlas shaft is to begin immediately.

As an outgrowth of the Atlas negotiations, stockholders of East Silver Belt Lead Mines, Inc., approved an agreement with Hecla under which Hecla is granted a 10-yr. lease to explore and develop the East Silver Belt property and to mine any orebodies opened by the work, paying to East Silver Belt a royalty of 10%. The East Silver Belt Lead Mines property consists of 67 unpatented claims extending westerly from the Atlas property to the Rock Creek group which is 95% owned by Hecla. The Moe group adjoins it on the north.

Hecla also retains a right to purchase a 9/10 interest in the property for $150,000 at any time during the 10-year option period. Royalty payments may be applied on the purchase price to the extent of $125,000, the balance to be paid in cash. Hecla may assign interest to its partners in the Atlas venture.

IN MINING

What the Major Mining Companies Are Reporting

- **American Zinc Finds Major Orebody in Tennessee**
- **Bunker Hill Says New Orebody Is "Of Major Importance."**
- **New Jersey Zinc to Develop New Orebody in Virginia**

ALUMINUM COMPANY OF AMERICA. Two programs are under way to boost the company's aluminum production of defense aluminum by about 50% annually: 1. A "quick action" plan to produce aluminum for the defense stockpile at a rate of 158 million lb. per year is already in operation using stand-by facilities and high-cost electric power at Massena, N.Y. (capacity 110 million lb. per year), and Baden, N.C. 2. Erection of permanent new capacity to produce 240 million lbs. of aluminum annually. This will be accomplished by increasing Alcoa's Point Comfort reduction capacity from 114 million to 184 million lb. per year, and erection of entirely new reduction facilities at another site.

A new plant for alumina production from bauxite is being built at Bauxite, Ark. The Tembladora ore transfer station in Trinidad has been completed. Shallow-draft shuttle vessels bring bauxite from Surinam to this point for transfer to deep-draft ships. Unloading capacity of the station is 1,000 tons per hr. Storage capacity of the station is 75,000 tons. Ocean going ships are loaded at the rate of 2,000 tons per hr.

No Monopoly. The long-drawn-out antitrust suit brought against Alcoa 14 years ago has ended, and Alcoa is now free of antitrust litigation. Federal Judge John C. Knox refused to break up the Alcoa organization as requested by the Department of Justice. Justice Knox stated that there was no need for such action; that a competitive situation did not exist in the aluminum industry; and that there was no monopoly of the industry.

ALASKA JUNEAU GOLD MINING CO. There has been no change in the standby operations of the Juneau operations during 1950. However, C. A. Norris, president, reports that a "few straws have appeared in the wind to indicate a softening of the anti-gold contingent. These no doubt have been influenced by persistent criticism and general disapproval of established policies of the International Monetary Fund, mainly supported by monetary gold of the United States, and which policies are accordingly influenced by the financial policies of the U. S. Treasury. The growing opposition to these policies among other important gold producing countries is no secret . . . and should eventually bring about a more realistic appraisal of the importance and true value of gold in a soundly-balanced economy."

Mr. Norris attributed part of the disproportionate amount of gold stocks lost by the U. S. Treasury in recent months to the fact that central banks of foreign countries have become more interested in adding to their own gold reserves in which there is more confidence than in the purchasing power of the American dollar.

AMERICAN ZINC, LEAD & SMELTING CO. There was no change in the price of any of our products during the first quarter of 1951. Demand for slab zinc, cadmium, sulphuric acid, and zinc oxide was substantially in excess of our productive capacity. Sales for the first quarter amounted to $18,700,847, compared with $10,358,383 in the same period of 1950.

During the first quarter we made a further extension of the ore discovery in Tennessee, which indicates a major orebody. The grade thus far indicated in the East Tennessee mining area is above average of our other Tennessee reserves and the geological formation indicates the possibility of blocking out a substantial tonnage of commercial ore. The ore from this property could be shipped to Mascot for milling.

WE PASS!

In our April issue we reported that Consolidated Mining & Smelting Company of Canada, Ltd. had undertaken major projects totaling $33,965,000 in value. On April 26, they raised us by $30,000,000 by announcing a huge hydroelectric project which will involve construction of a 200-ft. dam on the Pend Oreille River just north of the U.S. border, and the installation of two power units capable of producing 205,000 hp., and provision for two more. That makes the total project pot $63,965,000.

NEW JERSEY ZINC CO. At Palmerton, Pa., a new battery of nine vertical retorts for the production of slab zinc was completed in 1950 and is in full operation. This installation replaced the last of the old-type horizontal furnaces.

At Depue, Ill., a plant for the recovery of cadmium metal from various by-products was installed and is in operation.

Plans for increased production of ore have been completed or are under way at Ogdensburg, N. J., Austinville, Va., Gilman, Colo., and Hanover, N. M. At Friedensville, Pa., shaft sinking continued and construction of the surface plant is proceeding as planned. Barring unforeseen difficulties, this operation should be in production late in 1952 or early in 1953. An option to purchase the Ivanhoe property, close to Austinville, Va., was exercised and the company plans development of the ore. Plans for increased ore production will be completed in time to replace the amount of zinc ore which will be lost when the Franklin ore deposit is exhausted about two years hence.

ALUMINIUM, LTD. Canadian developments to expand production of aluminum call for the expenditure of $220,000,000, of which $160,000,000 will be set aside for the first stage in the British Columbia project, according to N. V. Davis, president. It has been determined that low-cost electric power, on which the industry depends, can be obtained by a major engineering project in the undeveloped area 400 miles northeast of Vancouver. A smelting plant and a town to house the working force will be built near the tidewater Indian village of Kitimat. Bauxite from the Caribbean and other areas will be brought to the plant.

Power and aluminum production facilities in Quebec's Saguenay district will be expanded at an estimated cost of $60,000,000.

Estimated increase in Canada's productive capacity from these new facilities will be 150,000 metric tons a year, which will lift total capacity to more than 550,000 tons of metallic aluminum.

KENNECOTT COPPER CORP. Production during the first quarter of

1951 was about 296 million lb. This compares with total production of 1,152 million lb. in 1950. Charles R. Cox, president, cited a recent statement by the National Production Authority administrator that requirements for copper for defense orders are expected to reach 70% of the available supply.

At Kennecott's subsidiary, **Chase Brass & Copper Co.**, civilian defense orders take about 30% of the total fabricated products. In addition to its production of brass cartridge cases, the Chase company plans to install equipment **for producing 90-mm. cartridge cases of steel.** The present order calls for 500,000 steel cases to be produced when equipment is installed at the rate of 100,000 a month. The company is also quoting on a proposal for additional equipment for 500,000 more steel shell cases also to be produced at the rate of 100,000 a month. All equipment is to be acquired at Government expense.

Ruth Pit. A major expansion program to increase copper output at Ruth, Nev., is under way. Ore averages 0.83% copper per ton. Production is expected to begin in about 28 months. On Apr. 4 the Government issued a certificate of necessity for this project.

CALUMET & HECLA CONSOLIDATED COPPER CO. The company's Wolverine Tube Division is ready to meet changed conditions due to the copper shortage. It plans to **switch to production of steel tubing** as copper and brass become scarcer. The metal shortage has also caused the company to propose to the Government reopening of two closed mines and development of a new orebody. New techniques in metal extraction could make these properties economic producers. Copper oxide, of which Calumet & Hecla is about the only important producer, is now growing in demand. The Navy takes about 25% of production for coating ship bottoms.

C&H's lead-zinc mine near Shullsburg, Wis., is expected to raise ore production to 1,200 tons per day by summer.

CERRO DE PASCO COPPER CORP. Metal production from company mines and other sources was as follows:

	1950	1949
Copper, lb.	50,415,300	46,366,035
Lead, lb.	69,271,037	79,836,166
Silver, oz.	7,331,394	7,007,060
Gold, oz.	28,563	26,963
Zinc, conc., tons	94,534	52,509

Recognizing that Cerro de Pasco "is one of the greatest lead-zinc orebodies in the world," the company considered construction of a $12 million zinc refinery in 1947. A 35-ton plant was authorized in 1948 and construction is expected to be completed by August, 1951. In 1949 a program was tentatively developed for the expansion of the electrolytic zinc refining facilities to 100 tons of refined zinc per day.

Following development of the Sterling process for electrothermic smelting of zinc by the New Jersey Zinc Co. in 1950, the Cerro de Pasco company revised its program accordingly:

1. The 35-ton electrolytic refinery will be put in operation as soon as possible.

2. Construction of a 35-ton electrothermic unit to operate by the Sterling process has been authorized and is expected to be completed by 1953.

3. If the Sterling process plant proves successful and economically advantageous, the company will consider construction of additional electrothermic or electrolytic facilities to increase production to 200 tons per day.

The units now being constructed, and any additional ones will be at Oroya.

Capacity of the **Paragasha concentrator** will be increased from 700 to 1,000 tons of lead-zinc ore per day, and a 500-ton unit will be added. The additional unit will be for flotation of copper ores from Cerro de Pasco, and in due course it is contemplated that it will be expanded and converted to the flotation of lead-zinc ores.

Copper refinery at Huaymanta. Half of this plant capacity will be converted to an electrolytic lead refinery thereby increasing lead refining capacity to 1,600 tons per day.

PACIFIC TIN CONSOLIDATED CORP. Dredging results for 1950 were as follows. Cubic yards dredged, 9,382,400; total metallic tin recovered, 3,098,831 lb.; metallic tin recovered per cu. yd. dredged, 0.33 lb.; metallic tin sold, 3,102,661 lb.; average price received per lb. of metallic tin, 90c.

[Average 1950 price for Grade A tin as quoted by *E&MJ Metal & Mineral Markets* was 95.539c., New York.]

Mining operations in Malaya were conducted under very trying conditions due to mounting activities of Chinese Communist guerrillas. At the close of the year 125 Malay special constables, fully armed, were on duty at the company mines together with five armored cars. For the first time since World War II, three dredges were maintained in continuous operation throughout the year, and plans are being made to rebuild a fourth dredge.

Ore reserves as of Dec. 31, 1950, were 108,081,000 cu. yd. expected to yield 42,441,000 lb. metallic tin.

CONIAURUM MINES, LTD. Ore milled during 1950 totaled 133,995 tons having an average grade of $9.271. Recovery was 96.9%. Ore reserves as of Dec. 31, 1950, totaled 68,314 tons averaging 0.245 oz. Unbroken ore reserves at the end of the year totaled 216,360 tons with average grade of 0.242 oz.

Rising costs, combined with a fixed selling price, continued to demand a higher gold content in vein material to qualify it as ore. Consequently certain low-grade sections were deleted from the reserves of unbroken ore. The following table shows how costs have risen over the past 11 years:

Comparative Unit Prices of Materials and Services

	1939	1945	1950
Gold (Without E.G.M.A.)	$36.32	$38.50	$37.92
B.C. Fir Plank	36.50	43.00	126.00
B.C. Fir Sq. Timber	37.00	53.00	135.00
Spruce 2 x 4's	35.00	53.00	73.00
Spruce 2 x 8's	35.00	53.00	73.00
10" Round Posts	.12	.17	.28
Lagging	.26	.40	.60
Cribbing Timber	.04½	.09½	.15½
Coal	8.05	12.67	16.18
Drill Steel	.11	.14¾	.17½
Steel Plate	.03½	.05¼	.07½
Rails	2.95		5.52
Pipe 1"	9.70	11.87	17.50
Grinding Balls	71.80	77.70	90.00
Rock Drills (Leyners)	460.00		1,100.00
Rock Drills (Stopers)	425.00	470.00	712.00
Powder	13.25	13.25	16.55
Cyanide	12.75	12.75	14.35
Wages (Surface Laborers)	.52	.62	.91
Wages (Muckers Helpers)	.58	.68	.97
Wages (Runners)	.65	.75	1.04

BUNKER HILL AND SULLIVAN MINING AND CONCENTRATING CO. The following metals were recovered from the company mine and on a toll basis from purchased ores during 1950:

Lead	75,249 tons
Zinc	14,950 tons
Antimony	1,151 tons
Copper	1,398 tons
Cadmium	174,428 lb.
Silver	11,949,907 oz.
Gold	3,668 oz.

Ore reserves as of Dec. 31, 1950, were 2,617,675 tons of Bunker-Hill type lead-zinc-silver ore and 396,801 tons Blue Bird type zinc-lead-silver ores, totaling 3,014,476 tons. The new orebody mentioned in the 1949 annual report on the Bunker Hill No. 17 level is now reported as being of "first importance" as the result of subsequent exploration.

Production of metals from the Bunker Hill mine in 1950 totaled 34,043 tons of lead, 8,676 tons of zinc, and 2,701,927 oz. silver. Reworking of old tailings yielded 3,677 tons lead, 1,352 tons zinc, and 189,271 oz. silver.

Sullivan Mining Co., jointly owned by Bunker Hill and Hecla, produced 53,921 tons of electrolytic zinc and 294 tons of electrolytic cadmium during the year. In the leaching plant, residues, dross and other by-products yielded the following additional metals:

Zinc	8,957 tons
Lead	3,984 tons
Copper	198 tons
Silver	550,664 oz.
Gold	1,994 oz.

(*News continued on p. 112*)

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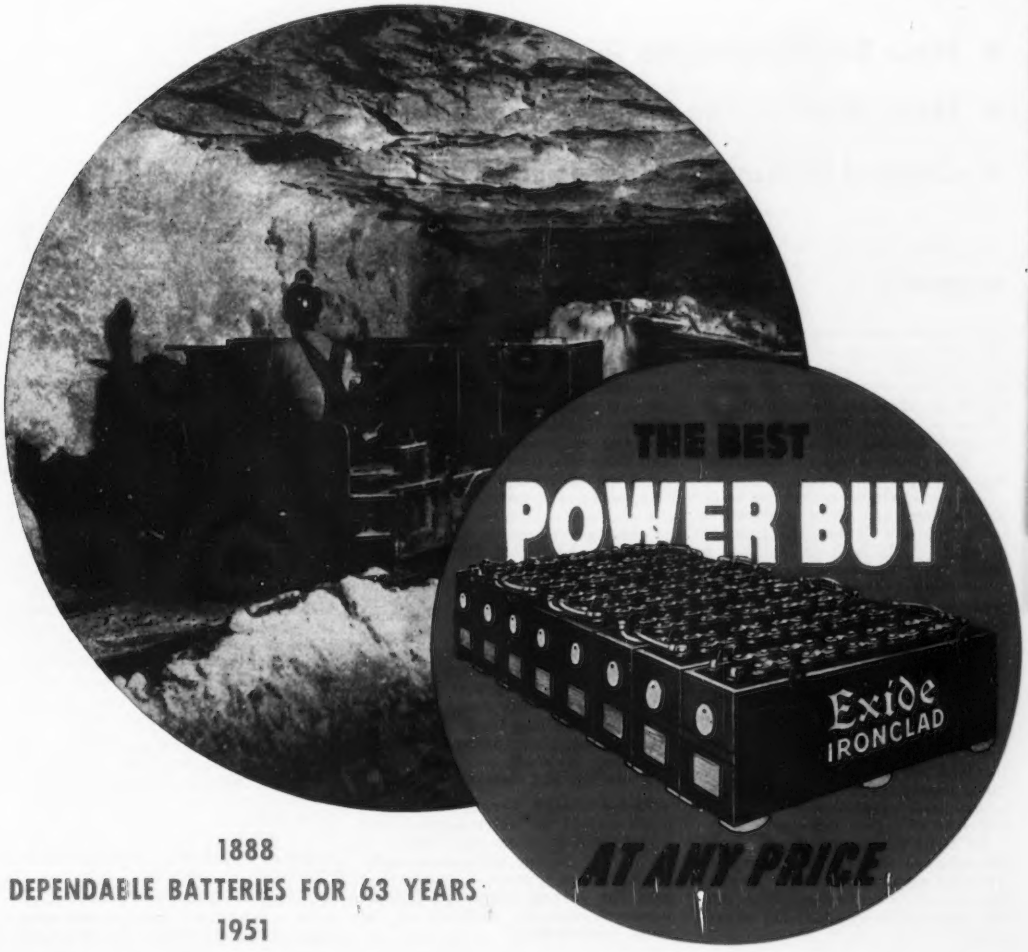
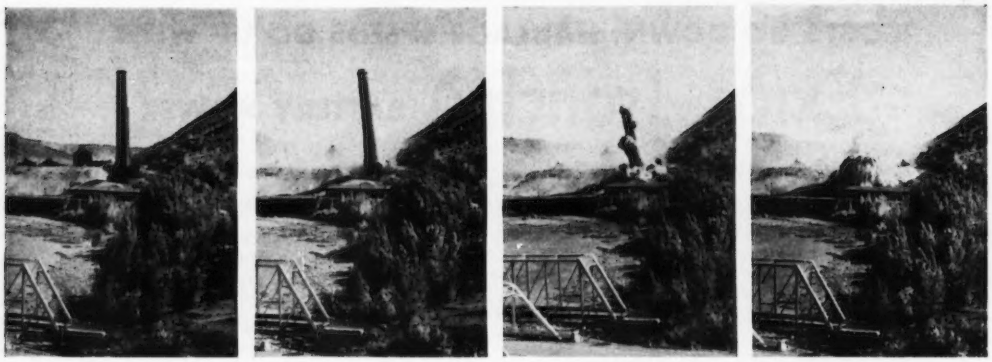


1888
DEPENDABLE BATTERIES FOR 63 YEARS
1951



TIM-BERRR! A 240-ft. smelter stack becomes a heap of rubble in Durango, Colorado. Built by AS&R in 1906, the stack was used until 1930 in handling San Juan ore. Leaning badly, it had to be dynamited in September, 1950.

IN THE UNITED STATES

- **New $5 Million Ore Pier at Baltimore**
- **New 10,000-Ton Mine for Nevada**
- **Ground Broken for New Taconite Plant**

ALABAMA

★**Tennessee Coal, Iron and Railroad Co.** is constructing an iron ore handling terminal at Mobile, Ala., on the site of the old Turner Terminal to handle ore from the Venezuelan operations of United States Steel Corp. Knappen Tippetts Abbett Engineering Co., New York, is doing the engineering on the project.

The port facilities are located on the Mobile River and serve as a transfer point for the high-grade iron ore brought in. The terminal slip will be 205 ft. wide and more than 1,500 ft. long. Present depth of 30 ft. below low-tide level will be maintained, eventually being increased to 40 ft. Equipment to be installed will be of the most modern type for transferring ore to railroad cars, river barges, or into stockpile.

The company expects to import more than 2,500,000 tons of ore a year from the Cerro Bolivar holdings and blend this with Alabama ore. With the additional supply the company plans to increase steel production by half million tons of ingots annually.

To blend the Venezuelan ore with the local ore, the ore conditioning and sintering plant near the TCI mines on Red Mountain will be enlarged, with the construction of additional storage silos.

ARIZONA

★**Uranium ore** mined in the Lukachukai Mountains of northeastern Arizona ranks among the richest in the nation, according to Dr. Phillip L. Merritt of the raw minerals division of the AEC. Charles H. Dunning, retiring chief of the Arizona Department of Minerals and Resources, says that the mine, located on the Navajo Indian Reservation, produces carnotite running about 0.4 of 1% uranium. He believes it to be the biggest uranium potential now known in the United States.

★**The Lone Star mine,** top fluorspar producer in Arizona, has been purchased by the Rich Creek Fluorspar Corp. of Elizabethtown, Ill. The mine is in the Whetstone Mountains. Discovered in 1946, it produced 200 tons of ore a month during 1949. Last year, when the shaft was deepened to 200 ft., production was 150 tons a month. New owners plan further expansion, deepening the shaft, construction of a new ore bin, and diamond drilling.

★**Phelps Dodge Corp.** will receive 5,000 acre-ft. of water annually for drilling and flotation requirements at its Morenci mining and copper smelting operation through a deal worked with the Arizona game and fish department and the residents of the Show Low district.

To supplement its meager water supply at the mine site, Phelps Dodge will obtain the first 5,000 acre-ft. flow of Show Low Creek, construct a dam and reservoir, and provide trout stocking ponds for the fish department. This water then will be turned over to the Salt River Valley Water Users Association for irrigation purposes in Central Arizona.

CALIFORNIA

★Four suits have been filed against the Yuba Consolidated Goldfields in Yuba, Calif., for a total of $500,000 in damages to farm lands. The company is charged with causing a break in a levee on the Yuba River by building a dike across the river. The break occurred during last November's floods.

★The National Resources Developing Co., Los Gatos, has announced the discovery of a **"sizable deposit of uranium ore"** in the Inyo-Mono County area about 40 mi. from Bishop. Leroy H. Halvorsen, vice president, said assays of ore have shown values "above commercial grade."

★Sixty tons of **copper-zinc ore** are being produced daily at the Penn mine near Camp Seco, which is equipped with a selective flotation plant. Enlargement of the plant and expansion of operations is reportedly under consideration by the management. Zinc is understood to be predominant in the ore mined at the 500-ft. level, with substantial deposits carrying copper, lead, gold and silver also exposed.

★Leases with purchase options on three Arizona properties have been taken by **Central Eureka Co.** Preliminary engineering and Government tests indicate the presence of about 3 million tons of copper and molybdenum ore averaging $6 a ton at present prices.

★Open-pit operation of **Tungsten Blue mine,** in the High Sierra tungsten area west of Bishop, will be carried out by

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California *(Continued)*

Don Burgner of Reno, Nev., who has recently purchased interests in the property. Burgner has changed the name of the mine to Shamrock Tungsten. He also operates the Black Horse mine near the Nevada-California state line off U. S. Highway 6. Ore from the seven tungsten claims included in the operation will be shipped to the U. S. Vanadium mill in Pine Creek, near Bishop, for processing. It is reported that the ore yields upwards of 0.6% tungsten trioxide.

COLORADO

★Joseph T. Hall, president of **Callahan Zinc-Lead Co.**, disclosed in the annual report that lower metal prices at the beginning of 1950 and a decreasing ore grade resulted in lower output at the company's Akron property near Gunnison. A substantial exploration program has been laid out to develop promising areas in the property and adjoining properties on which leases and option agreements have recently been concluded.

★The **Leadville drainage tunnel** will be pushed to the historic Pyrenees mine by 1952 to unwater 75 miles of undeveloped and submerged lead-zinc workings if $425,000 additional federal funds are granted. It has been estimated that large tonnages of defense-vital zinc, lead and manganese will be available if the tunnel is extended. The original tunnel, started in 1943, was shut down in 1945 after $1,000,000 had been spent to drive it 6,000 ft.

★Kanarado Mining & Development Co. has merged three important mining properties in the **Gold Brick mining district**—the Carter, the Raymond and the J. W. Stone properties. The properties, located on Gold Creek, northeast of Ohio City, and comprising a large block of patented mining claims are scheduled to begin operations at once, according to Charles T. Vashus, president of the newly-formed corporation. The company plans to begin operation of the Carter mill as soon as sufficient ore is stockpiled to insure continuous operation. The mill is capable of handling nearly 150 tons of ore daily.

★**Telluride Mines, Inc.** mill tunnel has been joined with the upper workings by the completion of an ore pass. The tunnel cuts the Smuggler vein about 2,300 ft. from the portal. The ore pass was started from the mill level tunnel last June and immediately a winze was started from the Pennsylvania level above to meet it. The two were connected recently. The distance from the mill level tunnel to the Penn level through the ore pass is 1,300 ft.

★**Hundred Gold Mining Co.** at Silverton, under general management of B. F. Webster, Jr., is planning to start its mill in Cunningham Gulch. The mill is being remodeled to accommodate ore from the Garyowen mine, which the company controls.

★Increasing mineralization is reported as crews advancing the **Leadville drainage tunnel** probe cautiously with 40-ft. drill holes for the abandoned Blonger workings, first of the flooded mines in their path. Now, at the 8,500-ft. mark, with only 1,600 ft. to go under the current contract, the tunnel crews have passed the halfway point and now have only 1,600 ft. between them and their objective, the Robert Emmett shaft, which is linked underground to some of the richest flooded mines in the Leadville district. Tapping the Robert Emmett shaft, 10,100 ft. from the portal, should drain most, if not all, of the Fryer Hill basin and perhaps some of the Carbonate Hill basin.

★**A. L. Blomfield, of Ontario,** former general manager of the Cresson Consolidated Gold Mining & Milling Co. and former general manager of the Golden Cycle mill, recently visited the new Carlton mill at Cripple Creek. Mr. Blomfield is now president and managing director of the Lake Shore Mines at Kirkland Lake. "It is my opinion that this is the best mill in North America," he stated, after inspecting the new mill.

★An average of 150 tons of ore are now being shipped daily from the Cresson mine at Cripple Creek to the **new Carlton mill.** There are 15 sets of lessees working the Cresson now and the shipments are divided almost equally between them and from company workings. Several more leasers have secured blocks of Cresson ground.

★**Molybdenum Corporation of America** is reported to have a crew of men reconditioning its Urad molybdenum mill in Clear Creek County. The Government is reported negotiating with the company for increased production of molybdenum under a guaranteed price contract.

★**Natomas Co.** holds a 50% interest in South Platte Dredging Co., operating its bucket dredge for gold at Fairplay, Colo. For the eight months' period ending Dec. 31, 1950, the operating statement reveals a net, before income taxes, of $115,485.

IDAHO

★In a circular letter to stockholders dated May 1, **Day Mines, Inc.,** announces the purchase of the Hunter mine and closing of a production agreement with the Independence Lead Mines Co. Deep development on the latter project is to start within 60 days.

★Ralph W. Neyman, a director of Hecla & Polaris, has been elected manager of the **Silver Summit Mining Co.,** controlled by Polaris. Other directors elected at the annual meeting were Harry P. Pearson, president; L. S. Eddins, secretary-treasurer and George M. Grismer, mine superintendent. From development ore produced from the 3,000, 3,200 and 3,400-ft. levels the mine has paid $500,000 to the Polaris Mining Co. on a loan of $1,145,829.50, advanced by Polaris for development work. Ore reserves as of Jan. 1, 1951, are estimated at 58,730 tons averaging 45 oz. silver and 1% copper per ton. During the year 1950 the company milled 49,892 tons of development ore which produced $501,791.54.

★During the year 1950 **Polaris Mining Co.** paid its stockholders $400,000, bringing the grand total paid to date $3,340,000, according to the company's annual report. Ore reserves as of Jan.

(Continued on p. 128)

Oliver Iron Mining Co. Begins Building Mesabi Range Taconite Pilot Plant

GROUND WAS BROKEN May 17 for a taconite beneficiation plant by Oliver Iron Mining Co., U. S. Steel subsidiary, in the woods northwest of Mountain Iron, Minn., where iron ore was first discovered on the Mesabi Range more than fifty years ago.

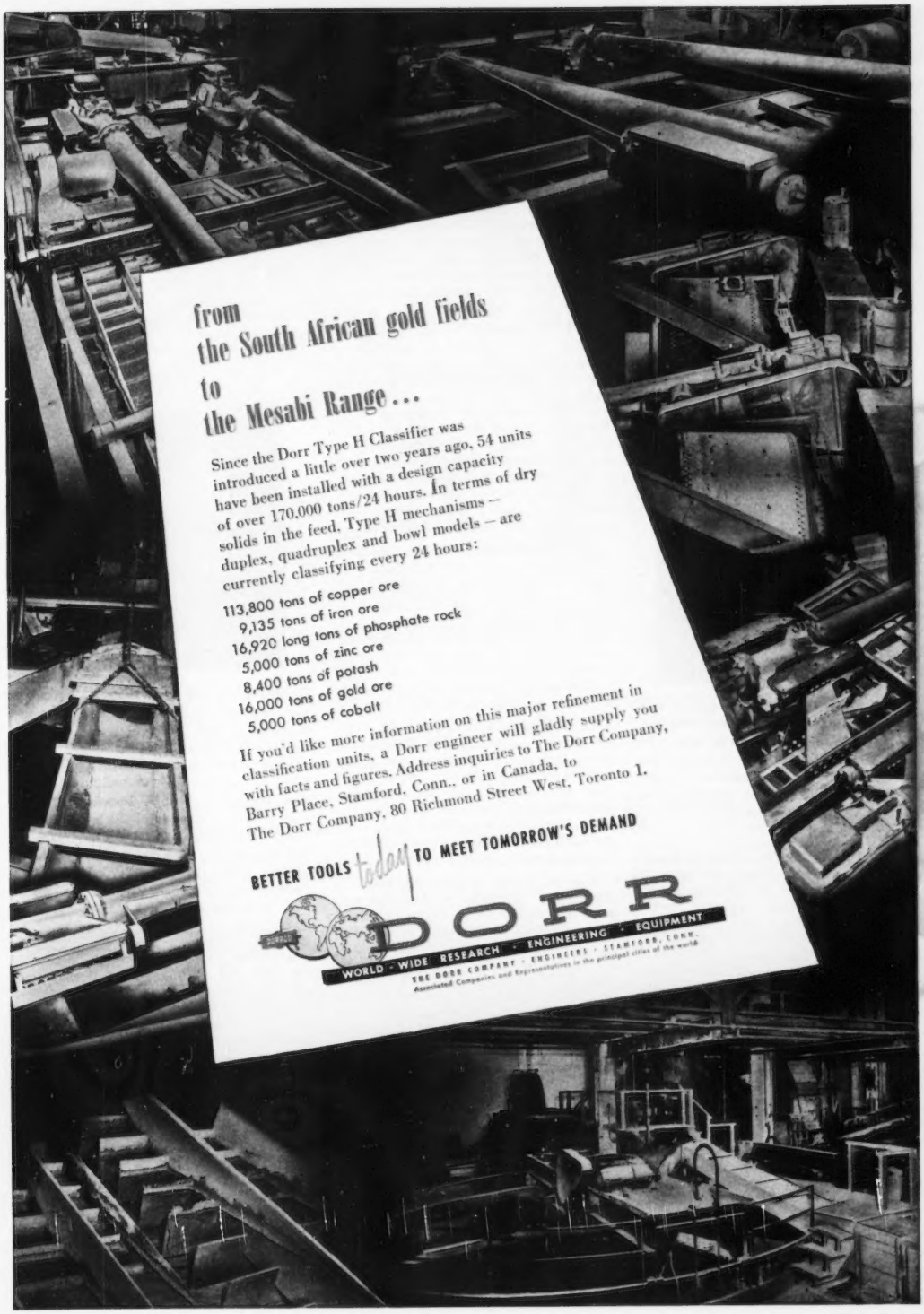
The plant, the first of its kind to be built by Oliver, will be operated on a pilot plant scale, and is expected to produce 500,000 tons of concentrate per year. At a concentration ratio of about four to one, 2,000,000 tons of crude taconite will have to be mined to produce that tonnage of concentrate. Ore will come from a new pit to be developed about a mile and a half from the plant site.

R. T. Elstad, president of Oliver, turned over the first spadeful of earth at the plant site at the conclusion of ceremonies attended by 250 guests.

"Construction of this plant will be a major part of Oliver's large and costly taconite experimental program," Mr. Elstad said.

Over the past two years, Oliver's drill crews have put down nearly 65,000 ft. of experimental drill holes in the hard taconite rock of the area. Research on the more than 12 miles of drill cores collected, proved the suitability of ore from the Mountain Iron site for pilot plant work.

The flowsheet will include four stages of crushing, followed by two stages of grinding, and magnetic separation. Other equipment will separate the non-magnetic iron from the silica. The concentrate will then be treated by agglomeration to yield nodules that will stand shipment down the Lakes and will be suitable for charging into blast furnaces.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to
the Mesabi Range...
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PERSONAL NEWS

Officers of the British Columbia-Yukon Chamber of Mines are: **F. E. Envoldsen,** honorary president; **C. E. Fisher,** honorary vice president; **Andrew Baird,** president; **Dr. B. P. Duvan,** vice president; **H. W. Firth,** secretary-manager; and **John Theed,** treasurer. The following are on the executive committee: **John R. Colbourne, Grant Barret, J. K. Halley, I. S. Comfort, E. P. Callison, F. H. Osborn, L. L. Rogers, M. D. Cole** and **J. Butterworth.**

Roland Erickson has joined the engineering department of the Reserve Mining Co. at Babbitt, Minn., on the Mesabi.

RALPH E. KNIGHT, assistant general manager in charge of the Chemical Division of Kaiser Aluminum & Chemical Corp., has been named vice president of Kaiser Magnesium Co. and Kaiser Bauxite Co., subsidiaries of the corporation. He has headed the Chemical Division since 1947.

Michael P. Walle, chief research engineer of the State Division of Lands & Minerals, at Hibbing, Minn., is on the committee appointed by the Minnesota Society of Professional Engineers for the development of the state's natural resources. This committee meets each month in Minneapolis under **Walter H. Wheeler,** chairman.

W. E. Goodman, Negaunee, Mich., has retired from the Jones & Laughlin Ore Co. after 40 years' service.

Russell LeDoux, Inter-State Iron Co., has been appointed chief engineer for the Hill-Annex mine at **Calumet,** Mesabi range. He succeeds **Clarence Sleeman,** who has been transferred to the firm's general mining offices under **Howard T. Caddy,** resident engineer for the company's Minnesota iron mining operations.

Paul M. Price has recently been transferred from the Chelan Division, Howe Sound Co., to its subsidiary, the Calera Mining Co., as an engineer.

R. W. Thomas, general manager of the Ray Division of Kennecott Copper Corp., has retired after 39 years' service with the division. He will remain until the end of the year in an advisory capacity. **A. P. Morris,** assistant general manager at Ray since September, will succeed Mr. Thomas, who had been general manager for 22 years. **Henry J. O'Carroll,** until recently with the metallurgical engineering office at New York, will become assistant to Mr. Morris.

C. B. E. Douglas, consulting mining engineer for U. S. Smelting, Refining & Mining Co., since 1945, has retired after 23 years' service with the company and its subsidiaries. He will continue to reside in Wellesley Hills, Mass. He joined the company as field engineer, then served successively as superintendent of the Mexican subsidiary through which exploration and examination work in Mexico were conducted, and sub-director of the Compania Real del Monte y Pachuca.

Keith Kunze, metallurgist, has been elected vice president of Central Eureka Mining Co., San Francisco.

Norman W. Foy, general sales manager for Republic Steel Corp., Cleveland, has been appointed assistant administrator of National Production Authority in charge of the new Metals and Minerals Bureau, with authority over the mineral commodity branches.

D. N. Vedensky, who has been a consultant on minerals benefication for M. A. Hanna Co. for several years, has been appointed director of research and development for the company, with offices in Cleveland. Mr. Vedensky was formerly a partner and chief metallurgist for Pan American Engineering Co., at San Francisco.

Roy A. Hunt, former president of Aluminum Company of America, has been named chairman of the executive committee. **I. W. Wilson,** senior vice president, has been made president of the company. **Leon E. Hickman** was elected vice president and general counsel by the board of directors. Mr. Hunt, son of the first president and one of the founders of Alcoa, served as president for 23 years.

Francis B. Speaker has been appointed chief of the Maintenance, Repair and Operations Branch of the Requirements Division, Defense Minerals Administration. He has been engaged both in mineral development and mining operations, and in the mining machinery industry, and during World War II served in the Mining Division of the War Production Board.

Joseph H. Reid, manager of National Lead Co.'s Titanium Division, has been elected a vice president of the company. Mr. Reid joined National Lead in 1927 as a mining engineer with the St. Louis Smelting & Refining Division. In 1936 he was made production manager of the Baroid Sales Division. He was made chairman of the mining committee in 1947, assistant manager of the Titanium Division the same year, and was appointed manager of the division in 1949.

John J. Collins has resigned from the U. S. Geological Survey to take a position with the mining department of American Smelting & Refining Co. as their special representative in Europe and Africa, with headquarters in London.

CARROLL L. WILSON, formerly general manager of the U.S. Atomic Energy Commission, has been named director of the newly-formed Industrial Development Department of Climax Molybdenum Co. Prior to his association with the AEC, he had been assistant to Karl T. Compton, president of MIT; a member of the prewar National Defense Research Committee, executive assistant to Dr. Vannevar Bush in the wartime Office of Scientific Research & Development, and vice president of the National Research Corp.

Franklin G. Pardee, deputy state geologist for Michigan, has been appointed chief of the Iron Ore Branch of Defense Minerals Administration. **James L. Head,** resident engineer, Anaconda Copper Mining Co., New York, on leave, has been appointed head of the Light Metals Branch.

Stuart H. Levison, general manager of zinc and coal operations of the American Smelting & Refining Co., has been elected vice president in the charge of those operations. He joined the company in 1912 as an assayer at the Monterrey plant in Mexico, and later saw service at the company's plants at Aguascalientes and Matehuala. He also served as assistant to **J. B. Woodul,** vice president of the Mexican smelting department, before becoming general manager of the zinc

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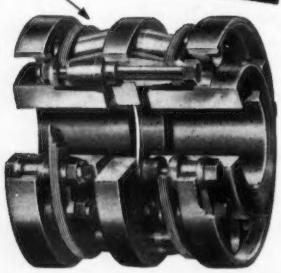

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and coal operations in 1930.

Fred F. Netzeband, who has been doing consulting work in the Salt Lake City region, has taken a position as commodity specialist in the Economics Division of the U.S. Bureau of Mines. His headquarters will be in Amarillo, Tex.

G. Chesterfield Evans has resigned from the Takuapa Valley Tin Dredging Co., West Siam, and has established a permanent residence at 38C, Mona Road, Darling Point, Sydney. Mr. Evans spent many years in Korea as metallurgist with the Oriental Consolidated Mining Co., and was also with Marsman & Co. in the Paracale region of the Philippines.

Parke A. Hodges, vice president of Behre Dolbear & Co., is on a professional mission in Turkey. **Dr. A. F. Banfield,** consulting engineer, has been making examinations in Wyoming and California.

GERALD R. STARK, of Texas Vermiculite Co., Austin, has been elected president of the Vermiculite Institute. He succeeds Stanley K. Robinson of F. Hyde Co., Montreal, Can. J. B. Lyall, of Vermiculite-Northwest, Inc., Spokane, Wash., was elected to the board of directors.

W. C. Sayer is consulting engineer for Heroya-Elektrokjemiske Fabrikker Co., Skien, Norway. The home office is in Henderson, Nev.

J. D. MacKenzie, vice president, and **R. P. Reese, Jr.,** assistant to the president, American Smelting & Refining Co., recently spent some time visiting the company's western smelters, and also attended the managers' meeting at Salt Lake City in April.

R. C. Skow, formerly assistant general superintendent at the Perth Amboy plant, American Smelting & Refining Co., has been appointed manager of the Omaha plant succeeding the late **Carl Gall.**

Roger I. C. Manning, field engineer for the Arizona Department of Minerals & Resources, will become department director on July 1, to succeed **Charles H. Dunning,** who has resigned to devote full time to farming ventures. Mr. Manning has been assistant director for many years.

E. W. Mills, of Salome, Ariz., has been elected president of the board of directors of the Arizona Small Mine Owners Association to fill the vacancy created last year by the death of **J. S. Coupal.**

Walter C. Lawson, manager of the New Cornelia branch of Phelps Dodge Corp. since 1948, has been named assistant to **Harrison M. Lavender,** vice president and general manager, effective July 1. He recently completed the new reduction works at the New Cornelia branch.

J. B. Pullen, manager of the Copper Queen branch of Phelps Dodge Corp., has been made manager of the New Cornelia division at Ajo. He directed details for opening of the new Lavender pit mine at Bisbee. **Carl E. Mills,** assistant manager of the Copper Queen division, succeeds him as manager.

Conrad F. Trowbridge has been appointed to an executive position in the Duluth office of Pickands, Mather & Co. He was formerly assistant to the vice president in charge of operations for the Pennsylvania Railroad.

H. M. Callaway, formerly with the Anaconda Copper Mining Co., Butte, Mont., has accepted a position on the geologic staff of Eagle-Picher Mining & Smelting Co. at Cardin, Okla.

George E. Morehouse, mine engineer for Telluride Mines, Inc., is now geologist with the AEC headquarters at Grand Junction, Colo.

B. J. DiSanto, former assistant plant manager at the Perth Amboy plant of American Smelting & Refining Co., has been transferred to Salt Lake City as chief engineer of the U. S. primary lead and copper smelters and refineries.

Howard G. Schoenike has recently been made geologist in charge of the Riddle nickel exploration of the Hanna Development Co., Riddle, Ore.

OBITUARIES

Frank M. Manson, 79, active in Nevada mining, died March 18 in Reno. He was connected with the early development of Tonopah and Goldfield. At one time he was head of the Western Ore Purchasing Co. and also the Utah Sampling Co. Mr. Manson helped to develop the Banner mine in Nevada City, Calif.

Carl Gall, manager of the Omaha plant, American Smelting & Refining Co., died April 5.

John W. D. Moodie, 83, retired mining executive, died April 8 in Pasadena, Calif. A native of Ontario, he studied at Upper Canada College. He worked for Phelps Dodge Corp. both in the U.S. and Mexico, and later became manager of the Yampa mine at Bingham, Utah, for Grant B. Schley. From 1911 to 1920 he was general

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manager of the Britannia Mining & Smelting Co., Ltd., subsidiary of the Howe Sound Co. Under his direction the capacity of this copper property was increased from 600 to 2,000 tons of crude ore daily.

J. C. Jensen, a mining pioneer in the development of Utah's Tintic district, died in Salt Lake City on April 30. He served as superintendent for the John Dern mining interests and later became vice president and general manager of the Knight Investment Co. properties in both Utah and Colorado. At one time he was director of Combined Metals, Inc., parent company of Combined Metals Reduction Co.

James L. Leonard, 42, Spokane mining engineer, died May 5 from injuries sustained in an automobile accident. He was active in the mining industry and had served as president of the Northwest Mining Association, the Spokane chapter of the American Institute of Mining & Metallurgical Engineers, and the Spokane Association of Engineers. In addition to serving as vice president of Leonard, Matthews & Ryan, Inc., a mining, mortgage and real estate firm, he was president of Metaline Mining & Leasing Co. and a director of Grandview Mines.

Letters to the Editor

DEAR SIR:

I read with great interest the factual article, "The Mother Lode Is Not Dead," by D. C. Demarest in your March, 1951, number.

This letter is to supplement Mr. Demarest's remarks about the Kennedy mine with some information given to me by the late Arthur Roberts, mine foreman when it was closed down as a result of the 1942 order.

At that time a new orebody was being developed on the 5,700 and 5,850-ft. levels. A winze had been started in this orebody and when work was stopped it had reached a point 5,862 ft. vertically below the surface, the deepest yet attained on the Mother Lode. The ore throughout, Mr. Roberts said, showed considerable visible gold and shortly before his death he gave me a specimen from the very bottom of the winze. This specimen may now be seen at the Amador County Museum here in Jackson.

As Mr. Demarest points out, along the Lode similar conditions exist in other properties, some deep, others shallow.

JEFFREY SCHWEITZER

Jackson, Calif.

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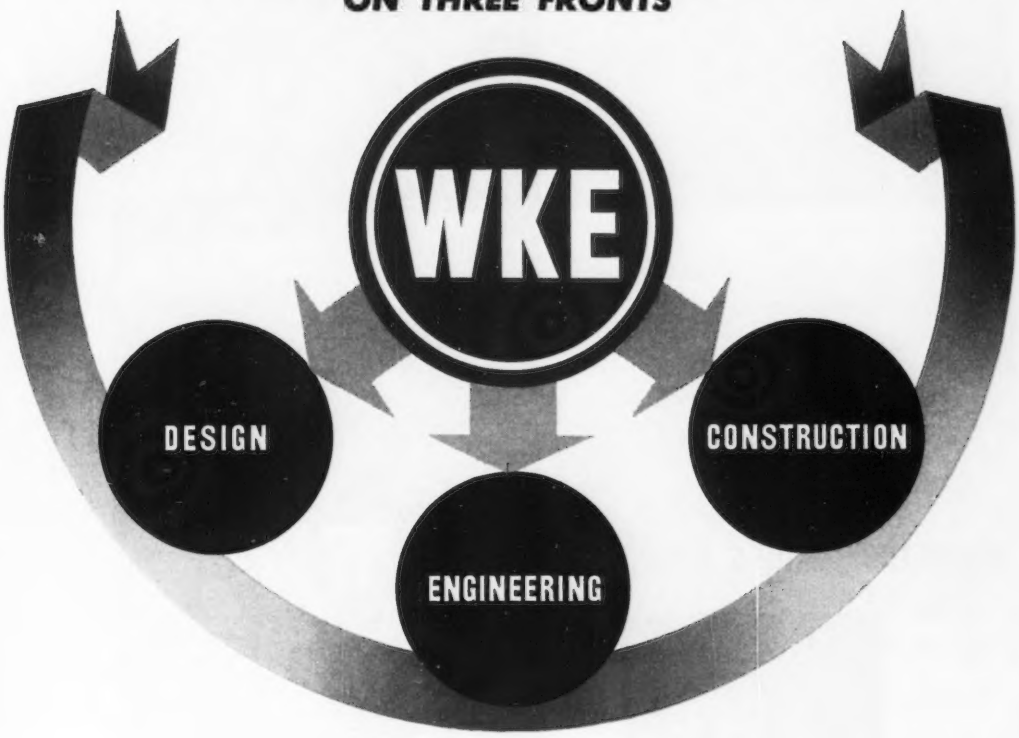

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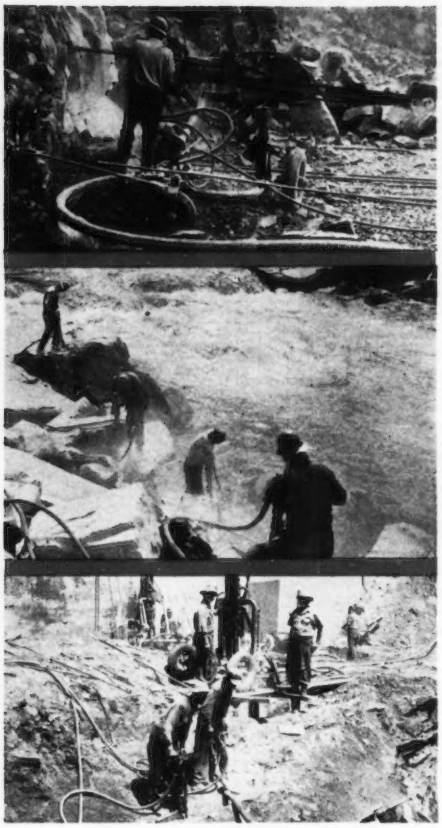

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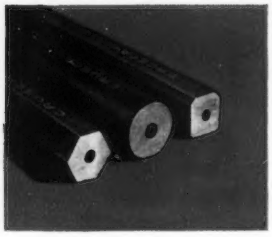

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REX HIGH SPEED • TOOL • STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

E & M J

NEW PRODUCTS DIGEST

For further information on these products, circle item numbers on card—insert and mail.

FEATURE

Two-Way Radio Saves Time, Speeds Work at Open Pit

OLIVER IRON MINING CO. is using General Electric two-way FM radio to speed work and save time at its Sherman operations in the Hibbing-Chisholm district of the Mesabi iron range in Minnesota.

The radio system consists of a station unit at the Sherman office, and five mobile units. Superintendent Sam Micka and his assistant have mobile units in their cars, the dump foreman has one in the switch house at the approach to all dumps, and general foreman's pickup truck has one, and one is located in the Fraser pit. Nerve center of the system is the Sherman office, and all conversations are heard there. Sam Micka can hear his key men discuss a problem, whether he is in his office or in his car.

SUPERINTENDENT near the pit, radios dump foreman that a shovel is changing from rock to dirt.

NERVE CENTER of radio system in the office, relays message from lab, "Shovel 79's ore is running lean."

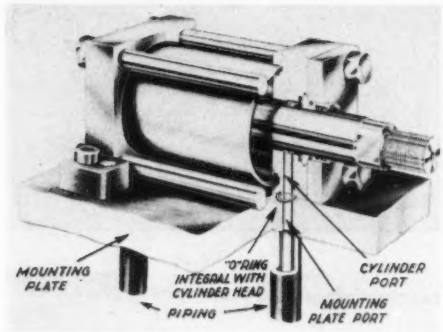
"Many things happen each day which prove what a money-saver this sort of communication can be," says Superintendent Micka. "For example, the operator at the office might receive a call from the laboratory stating that ore from a certain shovel is running lean. The office contacts the pit or a close-by car and relays the message. In a matter of minutes, the shovel stops loading the lean ore and the crews move to the desired grade of ore."

No longer does the superintendent drive for hours to locate his assistant, who might be only a thousand feet ahead or behind him. No longer does he worry about following through on the many details a superintendent must see to. He depends on his radio set, and saves much time in the process.

"These radios are a big help in our everyday job," Micka says, "and on some occasions they have helped in emergencies."

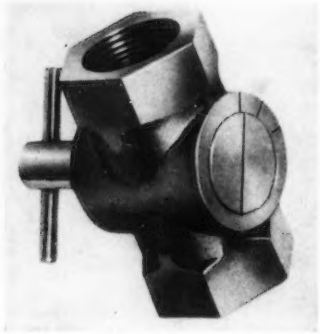
One emergency he will long remember happened during a heavy snowstorm, with the temperature 25 degrees below zero. Driving to the Sherman mine, his car developed fuel pump trouble and stalled. What might have been a very cold and uncomfortable situation for him was avoided when he called the office by radio and had help within 15 minutes.

For more detailed information on two-way radio communication, circle No. 1 on post card opposite p. 127 and mail, postage free.



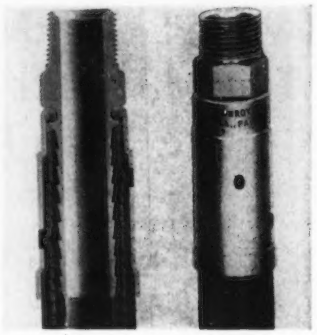
CYLINDER MOUNTING. "O" Ring seal makes direct connection of piping to mounting plate whose ports match cylinder ports, quick and easy. Saves time and labor. Miller Motor Co., Chicago. (2)

FLOW INTERLOCK. Device responds to a flow of water to open or close electrical contact. Acts like fuse in circuit which depends on water cooling for protection. One screw adjustment sets circuit for any flow from ½ to 4 gpm. General Electric Co., Schenectady, N. Y. (3)



FLOW REGULATING VALVE, made by Reynolds-Shaffer Co., Detroit, Mich., is made for ¾-in. to 2½-in. pipe. Finger-tip setting permits accurate regulation of flow of liquids through valve. Small and large port inserts available for each size valve. (4)

PRESSED - ON COUPLING, called "Press-Lock," made by Mulconroy Co., Philadelphia 31, Pa., is made of steel and exerts positive three-way gripping action on rubber hoses. Available for hoses from 5/16 to 2 in. inside diameter. (5)



Memos from the Manufacturers

Lindberg Engineering Co.: Philip J. Duffy placed in charge of new direct factory sales office in Atlanta.

Pioneer Engineering Works: Williams Tractor Co. appointed Kentucky distributor.

John A. Roebling's Sons Co.: New Chicago district manager is Walter Whiting.

Atlas Powder Co.: Formerly assistant to the president, R. K. Gottshall elected a vice president.

Byron Jackson Co.: Theodore R. Colville assigned the management of all advertising and sales promotional activities.

American Cyanamid Co.: Francis J. Verduin, Calco Chemical Division, Pigment Dept. sales representative, transferred to St. Louis territory; Dr. Frederic H. Adams appointed a research associate at Calco Chemical Division.

Worthington Pump & Machinery Corp.: A. F. Reinking, formerly assistant sales manager, named manager of Steam Turbine Sales Division; Edward Barwell named industrial relations coordinator to assist L. C. Ricketts, vice president in charge of manufacturing; Robert C. Tierney to be in charge of new vertical turbine pump plant at Succasunna, N. J.

Lee Rubber & Tire Corp.: Alonzo B. Maines appointed employment and safety director, and Lloyd H. House named production coordinator of Republic Rubber Division; G. F. Hodgson has retired after 40 years' service.

The Heil Co.: Appointment of John Barclay as general manager to succeed William E. Simons announced; William Schumacher named district sales manager at Hillside, N. J.; Robert Miller made sales manager of road machinery division.

Kennametal, Inc.: F. O. Hill transferred from Cincinnati to Cleveland as application engineer; Gordon Kimball appointed application engineer, district office, Springfield, Mass.

Westinghouse Electric Corp.: H. E. Grout named works manager of the Lima, Ohio Small Motor Division; W. P. Bell promoted to manager of manufacturing for Lima plant; C. F. Herbold appointed superintendent of quality control for Small Motor Division.

Chain Belt Co.: L. B. McKnight elected to newly created position of executive vice president.

Raybestos-Manhattan, Inc.: Charles Kuhn, oldest active employee of Manhattan Rubber Division, has retired after 57 years' service as a sales executive.

Allis-Chalmers: Arthur B. Kinley and Wayne L. Smith named generel machinery division sales representatives in district offices in the West.

Borg-Warner Corp.: Edmund F. Ball, president of Ball Brothers Co., elected to board of directors.

Willson Products, Inc.: Thomas A. Willson, Jr., elected vice president.

J. K. Smit & Sons, Inc.: Election of Pieter Smit as president announced.

Union Carbide & Carbon Corp.: Fred H. Haggerson, president, elected chairman of the board of directors.

◀ TOWER EXCAVATOR. Two steel towers, 40 ft. and 120 ft. high, 1,000 ft. apart, crawler mounted, use 6-cu. yd. buckets for excavating or stripping large areas. Sauerman Bros., Inc., Chicago, Ill. (6)

WORK CLOTHING, made of Union Carbide's staple fiber, dynel, is reported to be wearing 75% longer than standard fabrics in acid and caustic plant operations. Chem Wear Inc. (7) ▶

◀ SANDBLAST CABINET. Built-in rubber sleeves and gloves permit operator to clean small metal parts in handy sandblast cabinet. Interior is illuminated. Exhaust fan and dust bag make operation dustless. E. W. Sly Mfg. Co., Cleveland, Ohio. (8)

VIBRATOR. Permanently installed on air line, vibrator fits bracket on car. Helps empty car in 10 seconds. No bumping with locomotive is necessary. Cleveland Vibrator Co., Cleveland, Ohio. (9) ▶

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card opp. p. 127 and mail.

FLEXIBLE TUBING. Well illustrated bulletin from Bemis Bro. Bag Co., St. Louis, Mo., tells you how and where to use Flexipipe for the best results, and what the advantages of that particular brand are. (71)

ALEMITE CAPS. If you're worried about life of bearings in dirty gritty places, S. S. White Plastics Div., New York, suggests that their flexible plastic caps for Alemite fittings, described in their one-page bulletin P-5103, may help you (72)

SHOVELS, DRAGLINES. This 20-page catalog features the heavy-duty design and construction of the convertible ¾-yd. machine for excavating, erecting and material handling. Machinery assemblies, parts and attachments are shown in pictures and described in detail. Bay City Shovels Inc., Bay City Mich. (73)

FITTINGS. Particularly for those interested in pressure vessel work, Taylor Forge & Pipe Works, Chicago, Ill., offers catalog 501 on nozzles, welding necks and large diameter flanges. Complete description and engineering details are included. (74)

EARTH MOVERS. Euclid Road Machinery Co., Cleveland, Ohio, has just published two 16-page booklets covering Cummins and General Motors powered Euclid Equipment. Copies of EGM-1 and ECE-10 booklets describe and illustrate dump trucks, bottom dump Euclids, loaders, and scrapers. (75)

FLUOSOLIDS. Here is a well thought out, concise bulletin, "FluoSolids Roasting of Sulphides" (No. 7500), covering the use of Dorrco FluoSolids system as a means of producing SO_2 from pyrite and pyrrhotite. Dorr Co., Westport, Conn. (76)

CONCRETE. "12 Ways to Set Up for Central Mixing" (4 pages) is designed to show the economies and increased production that can be gained through pre-mixing and delivery of concrete in non-agitating equipment. Twelve types of central mixing plants are illustrated and briefly described in bulletin 111 now offered by Dumpcrete Div. Maxon Construction Co., Inc., Dayton, Ohio. (77)

LIFT TRUCKS. We haven't seen this one, but Lift Trucks Inc., Cincinnati, Ohio, announces the availability of comprehensive application data on 4 leading Steubing lift truck models. Data sheets give dimensions, dimensional drawings, capacities and operating performance figures. (78)

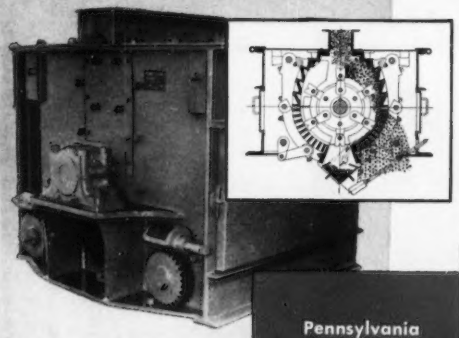
ELECTRO-CHEMICAL MEASUREMENTS. There's plenty of information packed in this 24-page bulletin No. B51-2, from Minneapolis-Honeywell Regulator Co., Philadelphia, Pa. Measurement of pH, redox and conductivity in industrial control systems is comprehensively covered. Fundamental principles of electro-chemical measurements as well as final control elements for automatic control systems are included. (79)

FILING EFFICIENCY. Are you troubled with bulging, unsystematic files? An encyclopaedic booklet on filing facts, "Kardex Cabinet Equipment," may give you the answer, whether your company is large or small. Fire protection, ready expansion and complete marshalling of fact power are stressed by Remington Rand Inc., New York. (80)

OPTICAL PARTS. Well organized

(Continued on insert opp. p. 126)

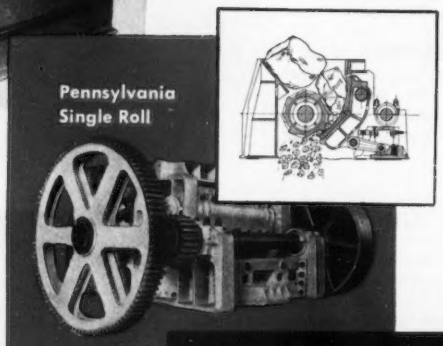
Pennsylvania Reversible Hammermill



why Pennsylvania makes many types of crushers

In the mining industries crushing problems are seldom, if ever, identical because there are variables such as product, feed size, capacity, moisture content, and physical and chemical structures of material—*and no one type of crusher can meet all of them.* That's why Pennsylvania has a large and varied line, a portion of which is illustrated here. In this line there is a type of crusher adapted to deal with each individual job no matter what it may be, and since our engineers are not limited to only one or two types when making a recommendation, you can be assured there is no bias or prejudice in favor of a specific crusher. This is one of the very good reasons to at least get Pennsylvania's counsel on every crushing job. Even if you aren't ready for a new crusher we'll be glad to check your operation and report on its efficiency. This could well be the first step towards reducing your operation costs.

Pennsylvania Single Roll



REVERSIBLE HAMMERMILL

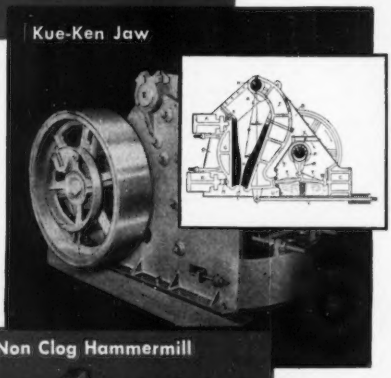
The Pennsylvania Reversible Hammermill with 2 Zone Crushing and Adjustable Cage offers great economy in operation and maintenance while producing a coarse or medium fine product without using a closed circuit system. The Reversible feature virtually makes this machine two crushers in one. Press a button—today clockwise—tomorrow, counter clockwise. Send for Bulletin 1034.

SINGLE ROLL

Requiring surprisingly little headroom, Pennsylvania Single Roll Crushers are powerful machines that have big hourly capacities at low cost per ton and can handle wet, sticky and frozen materials without choking or jamming. Massive Breaker Plate is easily adjustable to or from the Crushing Roll. This permits product size change at any time and also compensates for gradual wear of working parts. Send for Bulletin 2011.

What type of crusher do YOU use?

Kue-Ken Jaw



KUE-KEN JAW CRUSHER

The improved design of the Kue-Ken Jaw Crusher, using the "crushing without rubbing" principle, is the one great advancement in jaw crushers in many years. It replaces the old, poorly lubricated, slow speed, unavoidably heavy machine that gave operators a low opinion of the jaw. The Kue-Ken gives you — 2 to 5 times greater capacity, 5 to 10 times longer jaw plate life, much lower power requirement, a completely enclosed oil bath lubrication with clean, constantly filtered oil, and other features that put the Kue-Ken way out in front. Send for Bulletin 5011.

Dixie Non Clog Hammermill

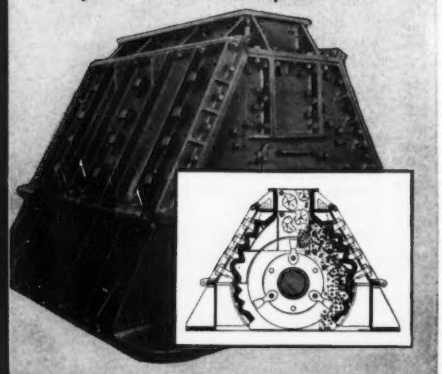
DIXIE NON-CLOG HAMMERMILL

Wherever sticky, wet materials may be encountered, there the Dixie Non-Clog Hammermill is without parallel in efficiency. The moving, extended Breaker Plate keeps the most difficult mucky feeds from choking the mill, holding production at peak capacity. The crushing is done *on* the numerous moving Breaker Plates, therefore wear is distributed over a large area, prolonging plate life, thus reducing maintenance cost.

REVERSIBLE IMPACTOR

The Pennsylvania Reversible Impactor reduces by direct impact at controlled slow speeds, producing cubed particles uniform in size. Reduction ratio is quite large, a reduction of minus 10" feed to ¼" in one operation is not unusual (closed circuited with external screening or separating equipment). This is an ideal crusher for high silicas and abrasive rocks, clinkers, minerals and chemicals. The Reversible Rotation feature doubles the life of principal working parts. Send for Bulletin 6016.

Pennsylvania Reversible Impactor



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PENNSYLVANIA CRUSHER COMPANY

PENNSYLVANIA CRUSHERS

(*Continued from p. 125*)

catalog of lenses, prisms and other optical parts manufactured by Bausch & Lomb Optical Co., Rochester, N. Y., includes description and dimension detail where available. (81)

LUBRICANTS. "Molybdenum Disulphide as a Lubricant" is a complete study of the subject, put out by Climax Molybdenum Co., New York. It is well illustrated, well written and highly technical. (82)

BLOCKS AND SHEAVES. Block number, capacity, number of sheaves, rope size and weight of block are included in the descriptions of the entire line of blocks and sheaves made by American Hoist & Derrick, St. Paul, Minn. The 24-page catalog has a section on how to figure line parts which should make reeving and line part figuring easy for riggers. (83)

VALVES. Detailed descriptions, sectional views, installation data and diagrams can be found in the 44-page illustrated catalog describing the complete line of valves made by Ross Operating Valve Co., Detroit, Mich. (84)

PUMP. "Hydroseal Pump" (Catalog No. 451) is an interesting booklet that tells you practically everything you want to know about the pump including performance characteristics. It also gives you some handy tables and charts for solving your pump problems. Allen-Sherman-Hoff Co., Philadelphia, Pa. (85)

PIPING POINTERS. "Piping Pointers" or "Helpful Hints on the Application and Maintenance of Piping Equipment" is a dandy 36-page manual covering the fundamentals of sound piping practice in non-technical language with plenty of how-to-do-its. Included, naturally, are some notes on equipment made by Crane Co., Chicago, Ill. (86)

PINIONS AND GEARS. An 8-page bulletin (GEA-1054B) on pinions and gears for transportation equipment has been announced as available from General Electric Co., Schenectady, N. Y. (87)

TRACKMOBILE. The gasoline powered Trackmobile runs on track or rail, to rassle railroad cars around or for hauling jobs in the plant area. Bulletin TM-101 tells you all about it. Whiting Corp., Harvey, Ill. (88)

BLOWER. A 6-page folder on the Standardaire blower gives dimensional information including engineering layout, typical application data, important design data, blower number, and cfm. rating at listed rpm. Standard Stoker Co., Inc., New York, N. Y. (89)

ATHEY PRODUCTS. Pocket-size catalog contains lots of pictures and plenty of information about the products, from breakers to dump trailers, made by Athey Products Corp., Chicago, Ill. (90)

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Don't take more than 3 minutes of your time!

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E&MJ OPINION POLL

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My chief interest is mining ☐ Milling ☐ Smelting ☐ Economic ☐ Other ☐

Remarks .....

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Name ..... Title .....

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	8	15	31	38	45	71	78	85
2	9	16	32	39	46	72	79	86
3	10	17	33	40	47	73	80	87
4	11	18	34	41	48	74	81	88
5	12	19	35	42	49	75	82	89
6	13	20	36	43	50	76	83	90
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Company .....

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featured on this and preceding pages of the New Products Digest.

Don't forget to fill in your name and address plainly.

Equipment Shorts

FLEXIBLE TUBING. Available in a variety of standard plys and materials, as well as specially engineered combinations, "Spiratube" is designed to satisfy most ducting requirements from 3 to 30 in. ID for air and other gases, and powdered, granular, or other light solids. Advantages (based on typical 8-in. tube) include 87% cubic reduction in size for transporting, 10-second joints without use of tools, temperature range from —30°F. to —250°F., higher on special order. Flexible Tubing Corp., Branford, Conn. (31)

URANIUM TEST KIT. Pocket-size uranium test kit permits quick, on-the-spot identification of radioactive ore findings. Used in conjunction with any ultraviolet instrument, it eliminates shipping every sample to a lab for testing. Menlo Research Laboratory, Menlo Park, Cal. (32)

STEAM CLEANER. Mining machinery can be completely, quickly and safely degreased and cleaned at any point in a mine where electricity and water are available, with the MSA All-Electric Steam Cleaner, made by Mine Safety Appliances Co., Pittsburgh, Pa. (33)

DUST COLLECTOR. For separating industrial dusts from the air stream and discharging cleaned air and toxic fumes out of doors, Model 90N50 Dustkop dust collector is available as a unit ready for shipment from stock. Pre-tested, it can be put into immediate operation with predictable results according to Aget-Detroit Co., Ann Arbor, Mich. (34)

HYDRAULIC CYLINDER. A hydraulic cylinder whose covers may be rotated for any pipe connection and installation in a minimum space, is offered by Rivett Lathe & Grinder, Inc., Boston, Mass. (35)

SOLENOID with ⅝-in. stroke, 10-lb. push, works on 110, 220 or 440 v. Practical Electric Co., Melvindale, Mich. (36)

Plus-Performance Plan

BATTERIES. To help industrial battery users get the maximum power and life from their batteries, Gould-National Batteries, Inc., Trenton 7, New Jersey, has devised the "plus-performance plan."

Just write the company stating (1) the kind of battery service concerned, and (2) points on which information is wanted. On receipt of the request, individualized portfolios will be made covering the technical information desired. Included may be reprints of technical magazine articles, instruction manuals, specification data with discharge curves, bulletins on battery construction, charging charts, sets of sample record cards, etc. Gould's engineering staff will also prepare individual studies and recommendations on specific questions. These services are without obligation.

New Factory Branch

TRUCKS. People in the iron country may be interested in obtaining a booklet entitled "Euclid on the Ranges." It discusses Euclid's new factory branch in Hibbing, Minn., and introduces the people who will be running the branch and the services they will provide. For a copy, write to Euclid Road Machinery Co., Cleveland 7, Ohio.

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This WHIRLCONE rubber-lined separator is the simplest and most efficient method of separating fines ever invented. Every one sold bears its own testimonial. Write for further information and prices.

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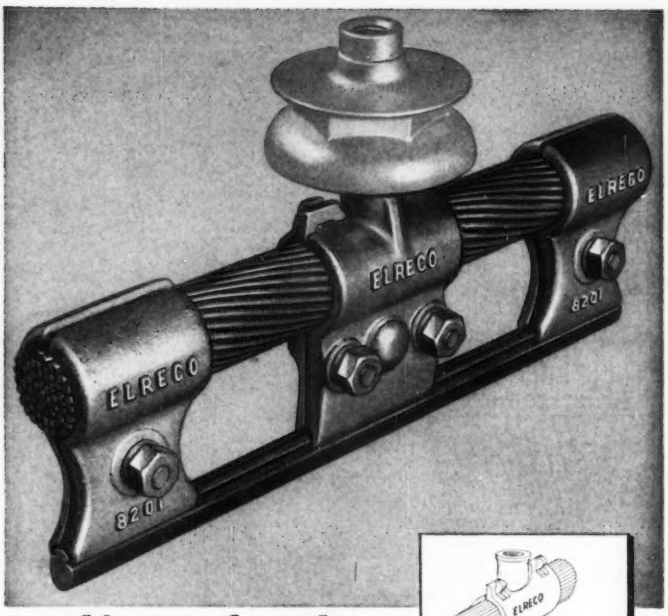
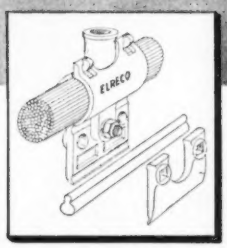
Exclusive U. S. A. Representatives

The 4" slurry pump pictured is the famous Georgia Iron Works slurry. These pumps are made in sizes from 2" to 14".





adjust feeder or trolley wire INDEPENDENTLY!

with exclusive Elreco Combination Clamps

You support feeder cable and trolley wire *independently* when you use exclusive Elreco Combination Clamps. This means that either trolley wire *or* feeder line may be installed, adjusted, repaired or removed at any time *without* disturbing the other.

Elreco engineers developed this clamp to give the mining industry the most practical means of supporting feeder *and* trolley wire ever devised. Made of heavy ribbed malleable iron castings, the Combination Clamp may be attached to any standard insulated hanger.

Elreco manufactures the *only complete line* of feeder and trolley wire supports. Duplex Spacer Clamps for supporting the trolley wire directly under a feeder make possible additional feeder capacity and insure an extremely flexible mounting where "headroom" permits.

The entire line is available in 5 sizes for Fig. 8, grooved or special No. 9 trolley wire, feeder cable from 0000 to 1,500,000 circular mils.

Write today for price and delivery information on our complete line of feeder and trolley wire supports. Address me personally, c/o Elreco, 2917 Cormany Ave., Cincinnati 25, Ohio.

PRESIDENT

Serving the mining industry since 1892

THE ELRECO CORPORATION

A COMPLETE LINE OF TROLLEY MATERIAL FOR EVERY MINE

Idaho *(Continued)*

1, 1951, are estimated at 235,000 tons in the Omega area and 272,000 tons in the Rotbart area above the 3,700-ft. level, both of which are mined and milled by the Sunshine Mining Co.

★**Sidney Mining Co.** has now completed sinking its three-compartment shaft to the 1,300-ft. level, 300 ft. below the Red Cloud tunnel level, from where it will open the vein system before going to greater depth. Distance west from the shaft collar to the west end of the company's ground is 2,000 ft., all of which, the company reports, "underlies the orebodies on the upper levels from which production has been carried on since 1924 and which will provide geological data on which future development can be determined."

★**Sunset Minerals** has opened a new streak of lead-zinc ore in the northwestern portion of the old Liberal King ground on Pine Creek while widening a drift for diamond-drill operations, according to Bliss Moore, general manager.

★Paul L. Sandberg, of Kellogg, reports that the **Bismark Mining Co.**, after five years of intensive prospecting on property a mile south of the Sunshine mine, has opened a vein of silver-lead-copper ore 4 ft. wide. A channel sample across the face showed assay returns of 5% lead, 4 oz. silver and 3% copper per ton. The property was originally owned by a group in Amsterdam, Holland, and was purchased by the present owners five years ago.

★Quicksilver is being mined again at Yellowpine by **Bonanza Mines, Inc.** For several years the price for the metal was so low that the company finally had to shut down its operations. The prevailing quotation is about $212 a 76-lb. flask, compared with the former price of $70 to $90.

IRON COUNTRY

★The lake iron-ore shipping season at the head of the Great Lakes opened officially on April 10, when the steamer Enders M. Voorhees of the Pittsburg Steamship Co. tied up at the Duluth, Mesabi & Iron Range Ry. dock at Two Harbors, Minn., for a cargo of iron ore. On April 11 the steamer Princeton of the Buckeye Steamship Co. entered the Duluth-Superior harbor to officially open that port. The first boat to arrive at the head of the Lakes loaded with coal was the steamer James Laughlin of the Jones & Laughlin Steel Corp. This boat docked at Superior on April 11. This is an earlier lake opening than last year when the first boat arrived at Duluth on May 1.

The mines began loading ore for boat shipments as early as April 6 and by April 20 almost all mines in the iron country were shipping. Oliver Iron Mining Co. began loading from

the Hull-Rust-Sellers mine on April 6 and from the Sherman mine on April 7. Pickands, Mather Co. began loading at the Mahoning mine near Hibbing on April 9. The M. A. Hanna Co. began loading from mines in the Mississippi group in the Kewatin area on April 9. All companies are working on full production schedule for this season and operations are being expanded as fast as shipping facilities permit. The goal of the Lake Superior area is close to 90,000,000 tons of ore to be shipped by boat this season. To add to this figure the Oliver Iron Mining Co. will continue to send shipments of iron ore from the Mesabi and Gogebic ranges to U. S. Steel's furnaces in the Chicago, Youngstown and Pittsburgh areas entirely by rail. The total tonnage of "all-rail" ore will depend on the ability of the railroads to supply the type of cars needed, but an estimate of 4,000,000 tons has been made for the year.

★On April 6, two men, Frank Putzel and Anton Korcha, were killed in a cave-in at one of the mines near Eveleth. Round-the-clock rescue went on for 90 hours before the bodies were recovered.

★The **Junior Mining Co.**, which plans to strip the Haley mine on and under Longyear Lake at Chisholm, has met with opposition from a group of Chisholm property owners. A hearing on the application for permit to mine was held by the Minnesota Conservation Commission on May 17.

★**Oliver Iron Mining Co.** will construct a new washing plant to treat wash ores from the Hull-Rust mine. It will adjoin Oliver's present crushing and screening plant near Hibbing. The plant is expected to be in operation by this fall and will increase the capacity of the Oliver company's washing plants to about five million tons a year.

★The Mahoning mine, operated by **Pickands, Mather & Co.** at Hibbing, was presented an award by the National Safety Council for outstanding safety performance during 1949 and 1950. Presentation was made on April 19 by Dr. Karl Nolte, representative of the National Safety Council for the area.

★A crushing plant will be built at the **St. James mine** at Aurora on the Mesabi. The construction was authorized by Oglebay, Norton & Co., manager for the St. James Mining Co.

★Stripping work done by the **M. A. Hanna Co.** on the Mesabi during the past winter amounted to nearly 12 million cu. yd. from 10 properties. The Buckeye mine at Coleraine moved the largest amount of surface, over one million cu. yd. The Morton mine at Hibbing was second with 952,248 cu. yd. removed.

★**M. A. Hanna Co. has closed its Duluth office**, as of May 1. Russell C. Fish, general manager of its iron ore

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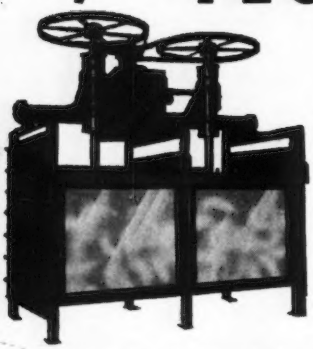

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Iron Country *(Continued)*

operations, who has hitherto made his headquarters in Duluth, has been transferred to the company's home offices at Cleveland, Ohio. This transfer will bring Mr. Fish nearer to the center of Hanna's iron mining activities, located as they are in Minnesota, Michigan, Missouri, New York and Labrador-Quebec.

MARYLAND

★Formal opening of the Baltimore & Ohio Railroad's **new $5-million import ore pier** was held May 15 in Baltimore. Designed to unload the largest ocean-going ore-carrying vessels within 24 hours, the facility is capable of transloading from ships to rail hopper cars as much as 10,000,000 tons of ore a year, or more.

Construction of the pier began in January, 1950. It is 650 ft. long, has two ore unloading machines with a combined sustained capacity of 2,000 tons per hour, and is designed so that it can be extended an additional 600 ft. to accommodate two additional ore machines if the demand for imported ore increases.

Iron ore from Liberia, Venezuela, Chile, Cuba and other foreign sources is expected to move through the pier in increasing quantities following its opening. Manganese and chrome and other ores also will be handled.

MICHIGAN

★The **iron ore shipping season** from upper Michigan ports began this year on April 6 when the steamer Joseph Sellwood cleared Escanaba, Mich., with a cargo of iron ore.

★Cleveland-Cliffs Iron Co. **Negaunee mine**, Marquette range, was exhausted in 1949. Plans call for deepening of the shaft and connection underground with the adjacent Athens mine.

★**Cleveland-Cliffs Iron Co.** has been shipping ore entirely by rail all winter from the Marquette range and expects to add to the boat shipments by this method for the rest of the year. About 500,000 tons of iron ore will be shipped all rail, the ore going to South Chicago and the Cleveland area.

★The first commercial attempt to **extract iron ore from low-grade reserves** on the western Michigan ranges will be made by the Hanna Coal & Ore Corp. near Randville, north Dickinson County. A $75,000 pilot plant for experimentation into possible commercial extraction of low-grade ore is to be developed. The new plant will experiment with ore which has about 30% iron content. The pilot plant is expected to begin experimental operation late this summer.

★**Calumet & Hecla United Steelwork-**

ers union, CIO, voted on May 3, 1,002 to 583, to accept Calumet & Hecla's offer of 15¢ an hour wage increase, thus averting a threatened strike. Operations at the mines, mills and smelter, which had been suspended for several days until a final decision was reached, were immediately resumed.

Besides the wage increase, the new contract includes provisions for a union shop if 80% of the employees vote for it in an election conducted by the NLRB. It also includes a provision for a reopening of negotiations on wages only once during the fiscal year, providing the price of copper increases or the company benefits financially from a subsidy or other Federal Government action. All other clauses of the 1950 contract are renewed in the new contract.

The wage increase will be made effective as of May 1, 1951, after the election is ratified by the Wage Stabilization Board.

MONTANA

★**Nancy Lee Mines, Inc.,** operating near Superior, Mineral County, has opened a vein in its lower tunnel, 170 ft. vertically below the upper tunnel. C. R. Ranney, mining engineer in charge of operations, states that this is a highly important development and the grade of ore assays commercial values in lead, silver, and zinc, with some copper.

★**What is said to be the first mastodon skeleton uncovered in western Montana,** was recently discovered by Ray and Clint Kallestad, who operate the Kallestad Sand & Gravel Co., at Deer Lodge, Powell County. A part of the skeleton was examined by two Montana geologists and an Eastern geologist, who place much importance on the find.

★**Anaconda Copper Mining Co.** has received an ECA certificate of cooperation in recognition of the vital part it has played in the Marshall Plan technical assistance program.

NEVADA

★Plans for the **largest mining developments** in eastern Nevada since the opening of the Ruth copper pit 43 years ago have been announced by John C. Kinnear, Jr., general manager of the Nevada Mines Division of Kennecott Copper Corp.

Kennecott's board of directors have authorized underground mining of an estimated 22,500,000 tons of marginal ore running about .83% copper and lying adjacent to and underneath the town of Ruth. Present plans call for operation of two shifts daily in the mine, removing 10,000 tons of copper ore daily to the nearby McGill smelter. It is estimated that 10 years of con-

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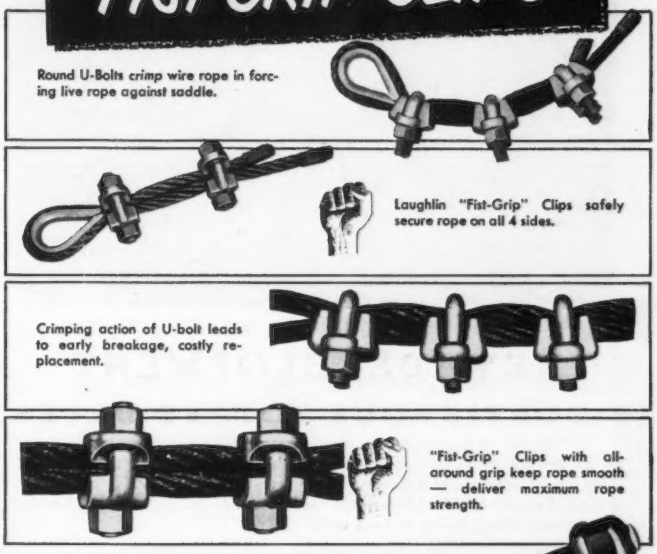
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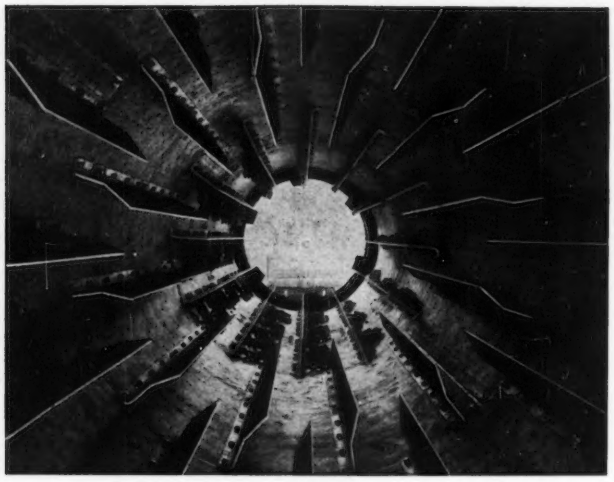
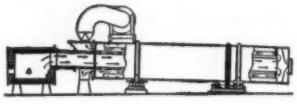
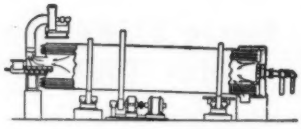


NEW DEVELOPMENT
IN CONTINUOUS ROTARY DRYERS

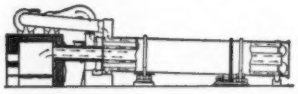
In the picture above you are looking at the interior of a "Ruggles-Coles" Class "XH" Single Shell Rotary Dryer designed especially for continuous drying of sticky concentrates. Note heavy chains for "knock-out" of materials behind lifting flights at feed end.



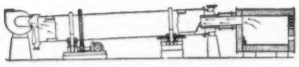
Class "XA" Double-Shell Direct-Heat Dryer



Class "XC" Rotary Steam Tube Dryer



Class "XB" Double-Shell Indirect Heat Dryer



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Nevada *(Continued)*

tinuous mining operation will be required to exhaust the orebody.

A 1,700-ft. shaft, 8x32 ft., will be sunk and will be equipped with modern high-speed equipment and safety devices. Counterbalanced skips will be able to haul 12 tons of ore to the surface on one trip. Eight miles of underground haulage ways will be built, as well as a spur railway line on the surface. Mining operations are contemplated on three levels.

Initial cost of the project is estimated at $7,000,000, and a capital investment of more than $13,000,000 will be involved in addition to operating costs. Production is expected to start within 30 months after the shaft is collared. Eventually a large portion of the town of Ruth will have to be moved to make way for the mining operations.

★Gus Rogers, manager of the **Winnemucca Mines Co.**, is completing construction work on a mill at the property on Winnemucca Mountain. The mill consists of two 50-ton units and will have amalgamation with a table concentrator and flotation for gold and silver ores. Provision has been made for conversion to treatment of copper, lead and zinc if necessary. Development of gold showings during the last year has proved that a large tonnage is available for milling.

★Development work is being started by W. J. Loring and associates on their group of **tungsten claims** in the Milley district 80 mi. north of Tonopah in Smokey Valley. The ore deposit was discovered by Louis and Philip Meyers, veteran Nye County prospectors, who recently sold their interests to Loring.

★**Desert Milling Co.'s** mill at Searchlight is daily treating 100 tons of gold-silver tailings from the old Quartette and Duplex mines. Charles H. Chandler, engineer and head of the company, is opening negotiations to acquire control of 2 million tons of mill tailings at Millers which is now owned by Mark Bradshaw, of Tonopah, and Albert Silver, of Reno.

★More than 400 tons of gold ore are being produced daily at the Gold Acres mine near Beowawe in Lander County. **London Extension Mining Co.**, with offices in Denver, is operating the property and has recently completed a new well on the site.

★The Gunmetal mine in Mineral County is now producing 65 tons of tungsten ore daily. The property is owned by the **Lindsay Mining Co.** and K. W. Dunham, manager, reports that 13 men are at work there. Six of the men operate the mill in connection with the mine and take care of the production. The mill is of the flotation type with a capacity of 100 tons daily.

★**Ohio Mines Corp.** in Esmeralda County is mining gold and silver in two operations. Underground a stope

is being developed, while on the surface waste material is being removed for an open-pit project.

★Sunnyside mine of the **Round Mountain Gold Dredging Corp.** has 82 men at work on its property where gravels from the mouth of the canyon are being carried by conveyor belt to the mill. The mill is operating in three shifts and is washing gold impregnated gravels at the rate of 12,000 tons daily.

NEW MEXICO

★Drought conditions which have prevailed in southwestern New Mexico during the past few years have caused the company officials of the **Chino Mines Division of Kennecott Copper Corp.** to seek water from the Warm Springs area, 12½ miles away from the Chino operations. Water from the Warms Springs area will be carried in a 14-in. pipeline some 8½ miles to the Apache pumping station, from where it will be pumped the remaining 4 miles to the mill in existing lines. The new line will be constructed of transite and steel sections. W. H. Goodrich, general manager of Chino operations, said that the project was receiving top priority, and that it should be finished by mid-summer. One shipment of pipe has already been delivered.

★ The Santa Fe Railway Co. has set up large-scale operations to ascertain the worth of uranium-bearing ores on railroad property near Grants. Offices are at Prewitt, 18 mi. west of Grants. A crusher has been set up and some ore shipped to Monticello, Utah, for refining.

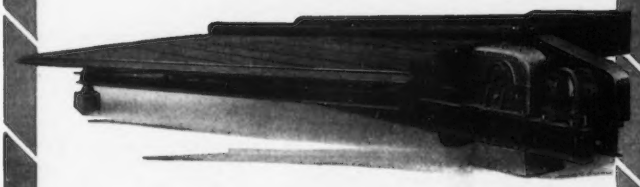
NORTH CAROLINA

★Initial steps were taken at a **meeting of miners** with the House Subcommittee on Mining and Minerals held at Asheville, N. C., April 16, for the organization of an association of miners to handle problems of mineral development in western North Carolina. Dr. Jasper L. Stuckey, state geologist, was named chairman of a committee which will conduct organizational work in each county in the area.

In urging formation of the association, Tom Cox, committeeman of Asheville, said, "We need someone in the area to go to for aid in developing mining profits instead of having to take a 1,000-mile trip to Washington and spend two days getting shifted from office to office."

L. B. Moon, chief of the Minerals Division of the U. S. Bureau of Mines, told the meeting that he understands that the Atomic Energy Commission is "considering" an extensive survey of western North Carolina for the possible presence of fissionable materials. He also stated that programs are now

Ask the Men Who Use Them



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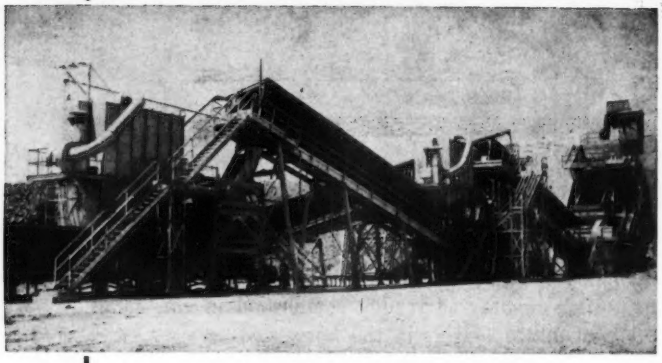

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North Carolina *(Continued)*

in effect in which the Reconstruction Finance Corporation can guarantee mining loans received from local banks. He said matching funds also are available from Federal sources for exploration, the funds running as high as 90% in the case of some materials and that an operator's labor can be considered as his 10% contribution. A contract program is available, he said, in which as much as 100% over market prices may be paid for some materials.

OREGON

★A resolution passed by the State legislature following **wholesale filing of mining claims** on extensive timberlands in southern Oregon, calls on Congress to enact legislation to put a stop to the filing of claims by persons who have no intention of developing the mineral resources.

★In a paper read at a session of the Northwest Industrial Minerals Conference at Portland, it was reported that the **value of industrial minerals of Oregon** climbed from $4,000,000 in 1939 to $18,000,000 in 1949. The paper was prepared by A. C. Bartel, managing engineer of the Oregon Raw Materials Survey, and R. S. Mason, mining engineer with the Oregon State Department of Geology and Mineral Industries.

★The newly organized **Tyrrell Manganese Co.** is preparing to reopen the old Tyrrell manganese mine in the Lake Creek area. The company, organized by Lester L. Sibley of Medford, plans to install a 50-ton concentrating mill, which will be available for custom milling.

★H. L. Waddell of Grants Pass has leased the **Liberty mine** which contains white tremolite asbestos and plans to operate it under the name of the Oregon Asbestos & Mining Co. The property is located in Jackson County.

UTAH

★Workers of the Utah Construction Co. driving the new 7,000-ft.-long $2,500,000 haulage tunnel at **Kennecott Copper Co.'s Bingham Canyon mine** are believed to have set a world's record for footage in a hard-rock tunnel of railroad width. According to Paul Guinn, work superintendent, the steel-supported tunnel has been advanced 805 ft. in 27 days as of April 8. The former record was believed to be 775 ft.

The tunnel is being driven from the Kennecott ore haulage railroad mainline in Bingham Canyon to a point 50 ft. below the present floor of the open-pit mine. The bore is standard

railroad size, measuring 21 ft. wide and 25 ft. high. It will give access to the 5,840-ft. mine level, whereas haulage at present is handled through a tunnel at 6,040-ft. level. The new bore will be four mine levels below the current mine floor when placed in operation at the scheduled completion time in mid-1952. It will carry all ore to be mined below the present tunnel level, and when finished, may carry more traffic per day than any other rail tunnel in the nation.

Despite the record speed of operation, no major injury or mishap had been reported among the 125 men on the project in the 27-day record period.

★Development of 160 claims in the Temple Mountain area south of Green River, plus erection of a 300-ton mill to handle carnotite uranium ores, is planned by the **Consolidated Uranium Mines, Inc.**

President George Frawley has reported that the firm's plan to spend some $750,000 on development also calls for exploratory drilling in the Sinbad and Iron Wash region of Utah.

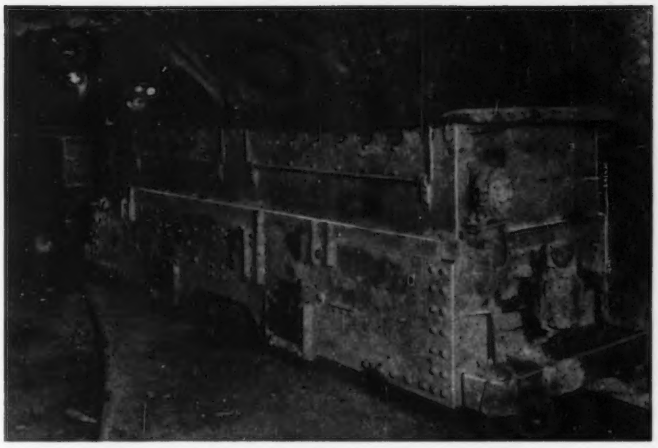
An AEC drilling program in the Temple Mountain region is reported to have disclosed deposits averaging 0.20% U_3O_8. Consolidated's plans call for an extensive drilling program of its own in addition to the AEC studies.

★Vitro Chemical Co., which recently took over the warbuilt Kalunite plant in Salt Lake City for conversion to processing of uranium ores, received its **first shipment of Marysvale district uranium-bearing ore** the week of April 1. Vitro, which has contracted with the AEC to refine autunite ore currently stockpiled at Marysvale, was expected to begin refining runs by mid-April.

★Construction of one of the largest mine projects to be undertaken in recent years in the region was virtually completed April 15 when **U.S. Smelting, Refining & Mining Co.'s $6-million Lark Tunnel** was holed through to the company's Lark No. 3 shaft. The project, under way for over two years, consists of a 21,014-ft.-long ore haulage tunnel at an elevation of 5,600 ft. in the Oquirrh Range.

The 4-mi.-long tunnel, put through by the Utah Construction Co., was driven at the expense of the Kennecott Copper Corp. It will serve to bring USSR&M ores from several ore bodies inside the underground workings to a common portal for shipment to the Midvale smelter. The new bore was needed in advance of the period, perhaps a half-dozen years from now, when Kennecott's big Bingham open pit will overrun USSR&M's present Niagara tunnel portal.

The present shaft No. 2 joins the new tunnel some 3 mi. from the portal, while the No. 3 shaft, completed last October, intersects the new haulage tunnel at the 21,034-ft. point. The No. 3 shaft likewise connects with the old Niagara tunnel at the 6,688-ft. level and is currently used to handle ores from a point near Copperfield. An in-



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Utah *(Continued)*

cline drift has been run into the Niagara from a point outside Kennecott's area to serve as a maintenance entry to No. 3 shaft after the old portal is closed. In addition, an 1,100-ft. shaft to ventilate the new haulage tunnel has been sunk.

Completion of the job, begun in November, 1948, is expected by summer, with only the laying of new trackage, electrical, water and air installations currently remaining.

WASHINGTON

★**American Lead, Zinc & Smelting Co.,** of St. Louis, announces the development of important zinc-lead ore reserves at its Lead Point property in the Slate Creek area of the Metaline district in Washington. The company is operating the Grand View mine, and mill at Metaline Falls and has been extensively but quietly prospecting the Lead Point property for several years, according to Howard I. Young, president.

★**The Old Dominion mine,** near Colville, Wash., has recently opened a 10-ft. wide vein, 4 ft. of which assays 130.7 oz. silver, 47.4% lead, 12.6% zinc, .15% copper and .05 oz. gold. An average sample across the entire 10 ft. assayed 98.3 oz. silver, 12% lead, 17.4% zinc, 25% copper and .04 oz. gold, according to Earl B. Gibbs, owner. The mine had been abandoned and idle since about 1885. Mr. Gibbs, a former Coeur d'Alene district operator and Ira M. Hunley, of Spokane, recently purchased both the Old Dominion and Bonanza abandoned mines in the Colville district and after striking a large body of lead-silver ore in the Bonanza property sold it to the Anaconda Copper Mining Co. for $2 million. Mr. Gibbs then purchased Mr. Hunley's interest in the Old Dominion and continued an old abandoned tunnel in the old workings a distance of 1,400 ft. before striking the present ore showing.

★As part of the present national plan to increase aluminum production for growing defense requirements, **Aluminum Company of America** will build a new aluminum smelting plant at Wenatchee, Wash. Capable of supplying 170 million lb. of aluminum annually, it is expected to begin producing within 15 months. Completion of negotiations between the company, Bonneville Power Administration and the Public Utility District of Chelan County, assures that necessary electric power will be provided. Construction of the new works which will cost about $45 million will begin immediately.

★Leo H. Timmins, president of **Chromium Mining & Smelting Corp.** said in Spokane in April that Pacific Northwest Alloys Corp. hopes to start production of magnesium at the Mead

plant by Aug. 1, and to be in full production by 1952. Reconversion is progressing satisfactorily with Morrison-Knudsen Co., reactivating the plant under a $1,500,000 contract. Since April 1, all four open arc furnaces have been producing ferrosilicon for the Government.

★Serial numbers for mines, smelters and mineral processing plants, which will be used in obtaining **priority and allocation assistance**, are to be established according to the Defense Minerals Administration. These serialization applications were to be filed with DMA on Form MF-100 before June 1. The form provides needed information in obtaining Government loans, purchase contracts, access road or other forms of assistance. Only those producers who have been granted serial numbers will be eligible for DMA help in obtaining facilities, equipment, machinery and operating supplies.

★At the annual conference of the International Union of Mine, Mill & Smelter Workers' Northwest Bargaining Council held in Spokane, lifting of wage controls and higher wages for mine workers were urged.

★The State Division of Mines & Geology, Department of Conservation and Development, has issued its 75-page **1951 directory of Washington mining operations.** Listed are companies, mines or properties, with addresses, locations and minerals produced, together with active metallic and nonmetallic operations being shown on maps.

★Tacoma's smelter's approximately 2,700 workers were to vote May 4 in a collective bargaining election. **United Steel Workers of America,** CIO, asked for the election. The workers were represented by Mine, Mill & Smelter Workers' Union, Ind., which was expelled by the national CIO recently.

WISCONSIN

★By June 1, it is expected that **Calumet & Hecla's** zinc-lead mine at Shullsburg will be producing at the rate of 1,200 tons per day. The current rate is 650 tons. The Shullsburg production will help relieve the shortage of zinc in defense work. Development at Shullsburg was started in 1948 and the production stage was reached the first of this year.

It has been estimated by the American Zinc Institute that recoverable zinc from domestic mines and available foreign sources may fall more than 100,000 tons short of domestic smelter requirements this year.

Domestic zinc smelters and pigment plants will need a total of about 1,050,000 tons of recoverable zinc in 1951. A maximum of 700,000 tons is expected to come from domestic mines, compared with a production of 593,203 tons in 1949, and 618,207 in 1950.

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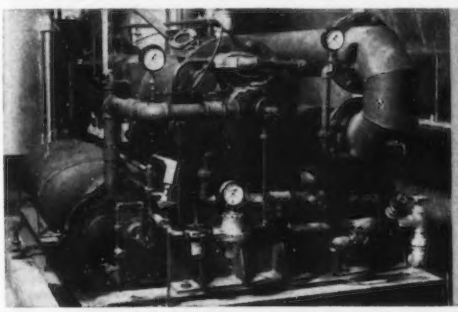

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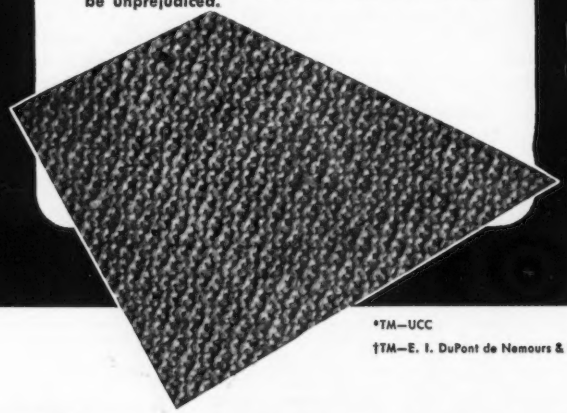

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Wisconsin *(Continued)*

Even if 1951 imports equal the 230,000 tons of recoverable zinc in concentrates imported in 1950, of which there is some doubt, there will still be an apparent deficit of 100,000 tons which must be overcome to fill the gap.

"In the light of this situation," says E. R. Lovell, president of Calumet & Hecla, "bringing into production the ore reserves at the Shullsburg mine of Calumet and Hecla is timely and of importance as to output of zinc."

Have you voted yet? Your ballot awaits opposite page 126.

IN LATIN AMERICA

BRAZIL

★**Cia. Vale do Rio Doce,** Brazil's chief exporter of iron ore, is arranging a long-term contract with **U. S. Steel Co.** for purchase of up to 50% of the Brazilian company's output. The Rio Doce company was set up with the considerable assistance of Export-Import Bank funds. It mines the high grade specular hematite ore from Itabira Peak. Last year the company shipped 710,000 tons, mostly to the U. S. and England. This year shipments are due to reach 1,200,000 tons, and 1,500,000 tons is expected in 1952. With U. S. Steel as a customer, perhaps expansion plans for the property can be realized.

CHILE

★**The U. S. State Department** announced early in May that Chile would receive hereafter 3c. more per lb. for her copper. The announcement left unexplained the manner of payment, and as this was written, it was still in doubt. Chile has been getting 24½c. U. S. buyers of Chilean copper have been paying this price, plus a 2c. tariff. With the tariff suspended, however, U. S. consumers could get Chilean copper, under the new agreement, by paying 27½c. per lb., 1c. more than they formerly paid. The big question, however, was what would happen to the domestic price of copper, and how this advance in price would be handled by the price control authorities. The State Department had nothing to say.

★**Braden Copper Co.** will advance $600,000, the equivalent of three years' toll charges, to the Chilean Government to mechanize the port of San Antonio, through which Braden ships its copper and receives supplies. The agreement was signed in Chile between Charles R. Cox, president of Kennecott, and Sr. Irarrazaval, Chilean Secretary of the Treasury.

★**The Farellon Sanchez mine and mill,** shut down for several years, are working again. The property was taken some time ago by Callejas Brothers. The mill can handle about 100 tons per day of copper ore. Feed is expected to run about 3% copper.

★**Cia. Minera Aysen** in Southern Chile, is milling about 1,300 tons of 40% lead ore per month. It also ships directly about 150 tons per month of 70% lead ore. The company is planning a flotation plant to handle zinc as well.

★**A Japanese commercial mission** visited Chile recently with the purpose of obtaining shipments of Chilean copper, particularly from the new Paipote smelter. The mission was headed by Mr. Kanosuke Hayami, head of the Taihel Mining Co. of Tokyo.

COLOMBIA

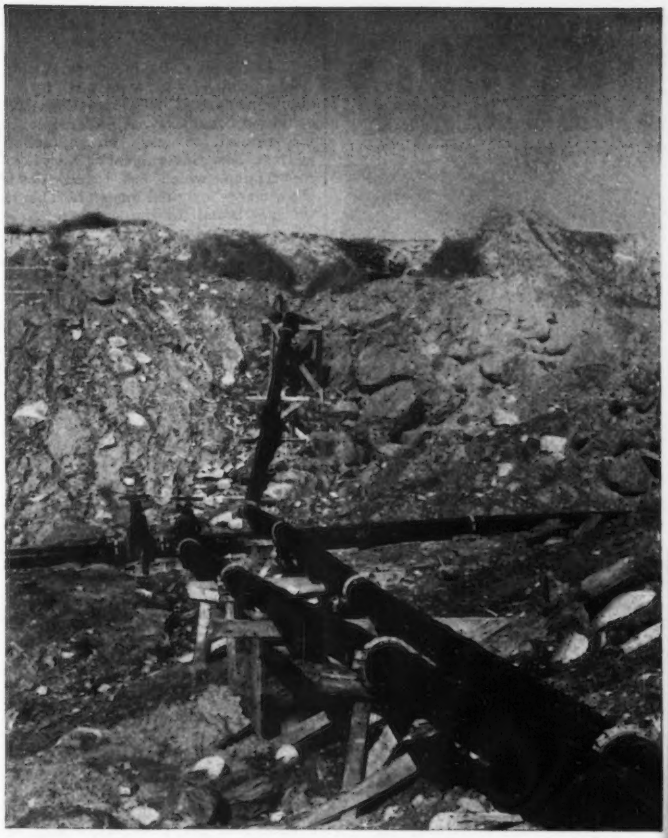
★**Seven French steel companies** have joined efforts to establish in Colombia a steel industry based on local raw materials and hydroelectric power. Known as the Paz del Rio Plan, the venture will require an initial investment of about $25,000,000. Production by the end of 1953 should be about 100,000 tons of steel yearly. The iron ores of Boyaca are the principle basis for the project, plus the high cost of importing steel products for the Colombian steel-consuming industries, most of which center around Bogota.

★**Sulphur production** in Colombia comes from just one company, Industrias del Purace, S.A., near Cali. Its output in 1950 was 1,484.6 metric tons. However, a large project is under way to apply in Colombia the new process developed by Chemical Construction Co. to handle low-grade sulphur deposits.

MEXICO

★**All but one** of the 27 major mining companies threatened some time ago by a general strike of the Mexican miners' union, have come to terms with their employees. Settlements range from increases in wages of 10% to increases of 14%, plus various additional benefits. Increases of all kinds probably total about $11,150,000 yearly, according to Jesus Carrasco, secretary of the union.

★Lone hold-out was the **Cia. Fundidora de Fierro y Acero de Monterrey, S.A.,** Mexico's largest iron and steel works. Its 4,200 employees walked out early in May demanding a 40% wage increase. The company says that a wage increase is impossible as long as the Government freezes iron and steel prices. Meanwhile, the strike is costing the company about $50,000 daily, and even greater damage has resulted from failure of one of the emergency crews to keep one of the blast furnaces hot.



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Mexico *(Continued)*

★**The wild-cat strike** in the Palau coal fields, which was climaxed by a "hunger march" on Mexico City, has collapsed completely. A Federal court has refused to issue an injunction against the Government's Board of Arbitration, which has turned down the strikers' original demands. This is the last round for the strikers.

★**The Mexican National Railways** had cheerful news for mining men recently with the announcement of purchase of 1,600 new freight cars and 36 new diesel engines to haul them. A good portion of this equipment must certainly be devoted to hauling ore and supplies for Mexico's mines. However, the country's basic need for 8,000 new freight cars is only dented.

★**Here are some discoveries** of ore, as reported to us: Col. S. D. Williams, Apdo. 16, Chilpanzingo, Mexico, reports finding copper ore running 30%, carrying 10½ grams of gold and 280 grams of silver per ton. Jose Evresto Limon, 3 Poniente 717, Puebla, Mexico, has brought in specimens of lead, mica, copper, and antimony ores from separate workings near the Oaxaca border. Francisco Anturez Echagaray, Puerto Real 7, Col. Condesa, Mexico, D.F., has a deposit of tungsten, fluorite, and copper ore in Zacatecas available for development.

PERU

★**The Peruvian Government** has announced an agreement with a French syndicate formed by the **Bank of France** and the firm of **Delatre et Frouard** to build a steel plant at the port of Chimbote. The plant will cost about $10,000,000 and will have an annual capacity of about 60,000 tons. The Corporacion del Santa will build the plant, which will use electric furnaces and other equipment from France. Power will come from the Canyon del Pato hydro-electric plant. Ore will come from the Marcona iron deposit, south of Ica, about 550 miles from Chimbote. The plant should be in production in about two years.

★**The Santander zinc property,** located west of Cerro de Pasco, seems destined for development. The mine was prospected and drilled in 1928 and 1929 by New Verde Mines Co. At that time the drop in the price of zinc stopped development.

★**Interest in antimony** properties is rising. Several foreign and domestic companies are prospecting, for example near Juliaca in southern Peru, and near Canta about 100 miles northeast of Lima.

DON'T MISS:
"Production For Defense"
E & MJ's July Issue

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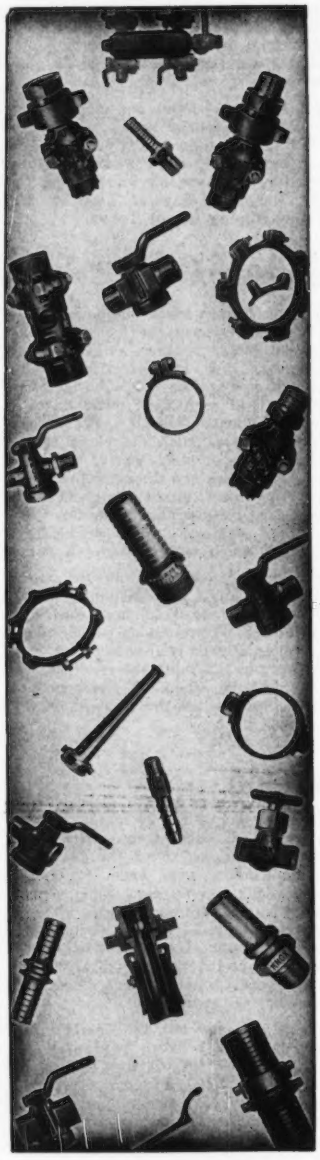

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IN CANADA

- **Rising Costs Squeeze Malartic Golds**
- **Labrador Iron Speeds Up**
- **New Exploration at Kirkland Lake**

BRITISH COLUMBIA

★Western Uranium Cobalt Mines Ltd. will **reopen the Red Rose tungsten mine** near Hazelton, with scheduled production to start late this year. A 75-ton mill is planned.

★**Radioactive showings** on the old-time Smuggler Hill mining property near Kamloops, on the North Thompson River, will be investigated this year by eastern mining interests.

★**Yale Lead & Zinc Mines Ltd.** has started milling at its Ainsworth property and plans immediate work on rehabilitating the Eden, Crescent and Krao mines as soon as the snow goes. Ore may be available by the end of June.

★**The new 100-ton mill** on the Cork Province lead-zinc-silver property of Base Metals Mining Corp., near Kaslo, is now in production. New ore of good grade is being developed on the new sixth level.

★**Three B. C. mining companies will merge;** Hedley Mascot Gold Mines Ltd., Giant Mascot Mines Ltd. and Silver Giant Mines Ltd. The new company will be known as Giant Mascot Mines Ltd.

★**Wellington Mines Ltd.** intermittent silver-lead shipper in the Sloan area, will be reorganized as New Wellington Mines Ltd.

★**Hamil Silver-Lead Mines Ltd.** has bought the mill of the Velvet mine in the Rossland area and will install it soon at its base metal mine at Argenta. The plant has a rated capacity of 190 tons daily.

★**First ore from Kootenay Base Metals Ltd.** mine is expected to be shipped this summer, and a 60-ton mill now being assembled is due to be in operation before the end of the year.

★Under contract from Consolidated Mining & Smelting Co., Marwell Construction Co., Ltd., of Vancouver, will build **a reinforced concrete loading dock at Galena Bay,** adjacent to Cominco's Bluebell Mine at Riondel. The dock, which will cost about $75,000, will have reinforced concrete deck 165 ft. by 65 ft. Lead and zinc concentrates from the Bluebell will be moved across Kootenay Lake on railway car barges.

★**Cronin Babine Mines Ltd.** has shipped 40 tons of high-grade silver-lead-zinc ore, the first of a series of carloads, to Trail smelter and plans to start milling by midsummer.

★**Mill construction** may soon be warranted by gold-silver-lead-zinc ore uncovered by exploration at the Sil-Van Consolidated property on Hudson Bay Mountain.

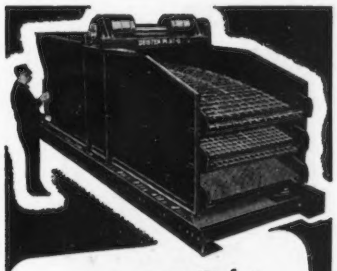
★**Shaft sinking** on the Guichon Copperado property has reached a depth of 367 ft. and a total of eight veins has been cut for an over-all width of 39 ft. of ore. A third shift will be added when the new powerhouse is finished.

★**Underground development is under** way at the property near Nelson of Columbia Lead and Zinc Mines, successor to Columbia Base Metals.

★**A contract has been awarded** by American Standard Mines Ltd. to the S. G. Behnsen Diamond Drilling Co. for a minimum of 7,500 ft. of drilling at the company's Hazelton property.

★**Kaslo Base Metals Ltd.** in Kaslo, has bought the Budweiser, Amazon and Spencer claims on Woodbury Creek in the Ainsworth mining division.

★**Hedley Yuniman Gold Fields Ltd.**



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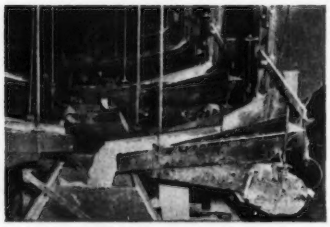

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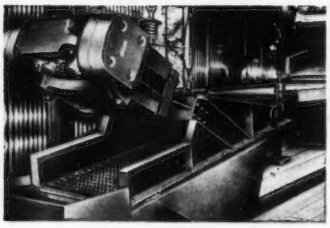

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British Columbia *(Continued)*

reports the new road to the Franklin group of zinc claims has been built and drilling was scheduled to start in late April.

★**In the Nelson district,** heavy mining equipment, including drills, compressors, air receivers, steel rails and mucking machines have been transferred from the Idaho property of Thomas Consolidated Mines Inc. to the Boy Scout mining property in the St. Mary's Lake district.

MANITOBA

★**Sherritt Gordon Mines Ltd.** announced on May 22 completion of negotiations with Newmont Mining Corporation of New York involving financing of Sherritt Gordon's new Lynn Lake venture, a project that will eventually produce about 17,000,000 lb. of nickel, 9,000,000 lb. of copper, and 300,000 lb. of cobalt annually.

The company will use a process developed by Professor Frank Forward of the University of British Columbia and Chemical Construction Corporation, jointly. The process uses an oxidizing ammonia leach, followed by solution purification steps, and recovery of nickel, copper, and cobalt as metals by chemical and metallurgical means.

The financing will be carried out in two stages. The agreement with Newmont covers only the first stage, involving development of the mines and production of concentrates. The $10,000,000 required for the first stage will be raised by sale of 1,188,886 shares to Sherritt Gordon stockholders at $2.00, plus sale of 1,000,000 shares to Newmont at $2.00. The remaining $6,000,000 will be raised by borrowing, in whole or in part.

In the second stage, coming in about a year, an additional $19,000,000 will be raised for the refinery.

YUKON

★**Yukon Consolidated Gold Corp., Ltd.,** earned a net profit of $728,640 in 1950, compared with $431,525 the previous year. The value of gold production was $2,540,841, from 6,835,964 cu. yd. of gravel mined by eight dredges. No drilling was done durng the year. Only several dredges will be used in 1951.

NORTHWEST TERRITORIES

★**Salmita Consolidated Mines Ltd.** had added four additional claims to its holdings in the Yellowknife mining division. The claims were staked to protect the southward extension of the Calmata North Zone and parallel ore occurrences to the west of the contact zone. The company has purchased additional machinery and equipment to augment shaft sinking equipment now on the property. The initial shaft has been selected and shaft sinking will begin early in the season.

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ONTARIO

★**The biggest new orebody discovered by Campbell Red Lake Mines** since underground work started has been partially outlined on four levels. First encountered on the 7th, or bottom, level, it has since been found on the 4th, 5th and 6th levels as well.

★With **conversion from open-pit to underground** operations completed, the Helen mine of Algoma Ore Properties is now supplying all ore for the company's big sintering plant, which this year will produce well over 1,000,000 tons of premium grade sinter.

★Sales and net profits of **Falconbridge Nickel Mines** in 1950 were the highest in the company's history, while ore reserves for the second year in succession reached a new all-time peak. This year will see Falconbridge's McKim mine placed in regular production, and will also see first underground work at the Hardy mine, where shaft-sinking is already in progress.

★**One gold mine that expanded both production and profits** in 1950 was Upper Canada Mines. This Larder Lake veteran upped its tonnage from 120,896 to 138,969 tons, and increased gold output from $1.3 to $1.5 million.

★**New mine-finding chances** for the Kirkland Lake gold camp can be visualized in the exploration agreement made by Lake Shore Mines with its southerly neighbors (both Lake Shore controlled), Kirkland-Hudson Bay Gold Mines, and Hudson-Rand Gold Mines. From its deeper workings Lake Shore will explore both properties. It is a long-term project, with work planned in a series of five-year steps.

Both junior properties have seen considerable exploration at intermittent periods through the years. Hudson-Rand, for instance, has its own shaft and winze to 1,425 ft., though these workings have been closed for many years. Kirkland-Hudson has been probed by extension of Lake Shore workings at a number of horizons. Good ore indications have been had at both properties, though nothing of mine-making proportions. First work under the new arrangement will be on the 6,575-ft. level, already extended well into Kirkland-Hudson ground. Drifting will be done there on a break that shows good promise, and the crosscut will be extended for a similar probe into Hudson-Rand ground.

QUEBEC

★The adverse effect of **rising costs on gold mining** is evidenced in the annual reports of both East Malartic Mines and Malartic Gold Fields. Both companies at the close of 1950 wrote substantial amounts of ore out of their reserves, eliminating marginal material which could no longer be mined at a profit under present cost conditions. Both mines, however, are well supplied with ore. East Malartic, with 1.9 million tons, has close to a five years' supply assured, while Malartic Gold Fields shows close to seven times the 606,096 tons milled in 1949.

★**Lamaque's ore reserves** at the end of 1950, 2.59 million tons, were the largest the company has ever reported. Although earnings were down slightly, the mine had a favorable year, with good progress made in its big expansion program. The mill is scheduled to step up this summer to 2,000 tons daily from its present 1,500 tons.

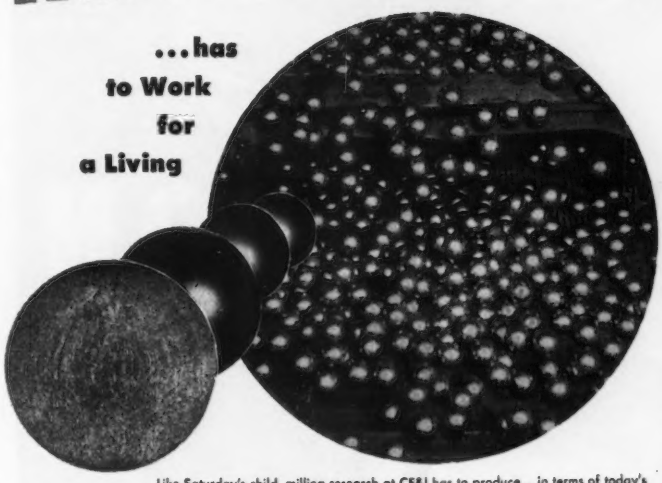
This year, too, will see the establishment of the company's second mine, about a mile from the present workings. A 1,200-ft. shaft is being sunk there on the known extension of the main zone from the adjoining Sigma workings.

★**Lateral work is going ahead steadily** on the 260 and 540-ft. levels at the Thetford property of United Asbestos Corp., following completion of shaft-sinking early in the spring. In the meantime additional ore indications have increased the mine's already substantial potential, a new orebody having been found by surface drilling on the west side of Black Lake.

★**Quemont Mining Corp.** continues to grow and prosper. It is now out of debt, having paid off the last of its

RESEARCH for better milling

...has to Work for a Living



Like Saturday's child, milling research at CF&I has to produce...in terms of today's commercial grinding practices. Mill operators think in terms of cost per ton of finished product, metallurgical efficiency, etc. That's why they are glad to work with CF&I's ore-dressing staff on current grinding media problems.

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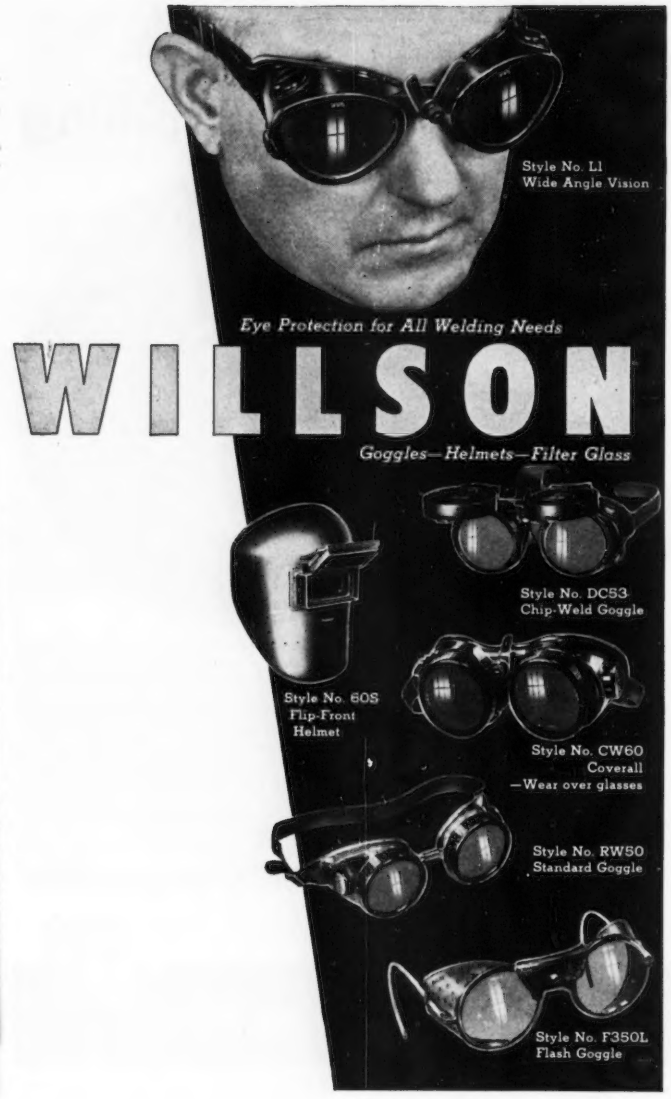

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Quebec *(Continued)*

$6.9 million production loan. Possibilities for an initial dividend before year-end are considered good.

★Over-all mining costs of Stadacona Mines (1944) Ltd. in 1950 were the lowest in some years with the result that profits, despite lower gold output and cost-aid, were almost as large as those of 1949. Ore reserves at year-end stood at 436,171 tons, somewhat less than three times the 140,145 tons milled during the year.

SASKATCHEWAN

★Mineral claim staking reached an all-time high during the fiscal year ended March 31, 1951. A total of 1,293 claims were staked and recorded, topping the 1,180 made in 1937 during the gold rush of the late 30's. About 80% of the claims staked were on uranium bearing ores. About 70% were in the goldfields—Lake Athabasca area, and about 10% around Lac La Ronge. The remaining 20% were scattered throughout the other mining districts.

IN INDIA

★Two uranium-bearing belts have recently been discovered in Eastern and Central India, according to Mr. Sri Prakasa, India's Minister of Natural Resources and Scientific Research. The Government is pushing development by means of grants-in-aid, contracts to purchase ores, and prizes for discovery of high-grade deposits.

★The Indian Government has set up its own company to work uranium ores and other radioactive minerals. Called Indian Rare Earths, Ltd., the company already owns a 1,500-ton monazite processing plant at Always in South India, and a second plant is planned to handle uranium and thorium production.

★The Geology Department of the Andhra University in South India has completed a survey of the radium content of South India's rocks. Using a thin-walled envelope type of Geiger counter, the equivalent uranium content of rock types from many parts of South India has been measured. A new scale-of-two unit was designed for the work, which is said to be more reliable than former instruments, more compact, and less expensive.

★The American Brainard International Co. will soon set up a ferro-manganese plant in India at an estimated cost of £750,000, by agreement with the Indian Government. Annual capacity will be 25,000 tons of ferro-manganese. Located in Orissa, the plant will be owned 49% by Indian capital and 51% by the American firm.

IN THE PHILIPPINES

★The annual report for 1950 of the **Atok-Big Wedge Mining Co.** reveals that normal development work during the year disclosed new ore valued at $1,796,000. Operating costs were reduced $1.55 per ton below 1949. While the gold content per ton of development ore declined below the average grade of ore milled during the year, the present prevailing high price of gold in the open market in Manila, currently 160 pesos an ounce, offsets the decline to a considerable extent.

Almost all the ore developed in 1950 was found in levels 9 and 10 on the Keystone vein and on the 6, 7, and 8 levels in the Keystone Hanging Wall vein. Ore reserves as of December 31, 1950, totaled 433,803 tons averaging $9.51 per ton. This represents a considerable drop from the average of $11.47 per ton recovered during the year from milling 160,707 tons averaging $12.03 per ton. Mill recovery was 95.3%, a gratifying increase over 93.9% in 1949.

Considerable improvement resulted from additional settling capacity through conversion to tray thickeners. Total value of bullion produced during the year was $1,944,227 at the statutory price of gold. The realized value was $2,636,338 or about $50 per ounce of gold which reflects the premium paid in the open market.

Operating costs were $1,257,988 or an average of $7.82 per ton milled. This included mining, milling, marketing, general overhead at mine and the Manila head office, and the mine products or severance tax of $141,665. Net operating profit after book charges was $907,382 and after deducting income taxes, final profit was $760,578. Four dividends were declared during the year totaling $798,551.

★Ore reserves of the **Mindanao Mother Lode Mining Co.** increased substantially in 1950 according to the annual report. At the end of the year total reserves were reported at 234,234 tons averaging 0.59 ounces gold per ton, valued at $5,117,800 including some $309,000 for copper and silver as by products. This was an increase of over 50% since December, 1949.

During the year the mill treated 111,600 tons of ore valued in excess of $2,000,000 at the statutory price of gold. Average value per ton milled was $18.1.Direct operating costs including mining, milling, marketing, and general overhead charges were $14.72 per ton. Gold recovery improved to 89.6%. Milling cost was $2.50 per ton, marketing and refining $1.84.

Of the 111,600 tons sent to the mill in 1950, 71,262 tons came from the stopes and 40,337 tons from development headings. There was little difference in grade between the two sources of ore. Vertical panel stoping was ex-

FILTERS

Even in the States, ore concentrating mills are distant enough from the factories where milling equipment is manufactured; but what of the mills in South Africa, Philippines, South America, Mexico, Scandinavian Countries? Separating distances can be measured in the thousands of miles.

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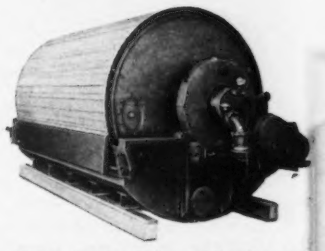

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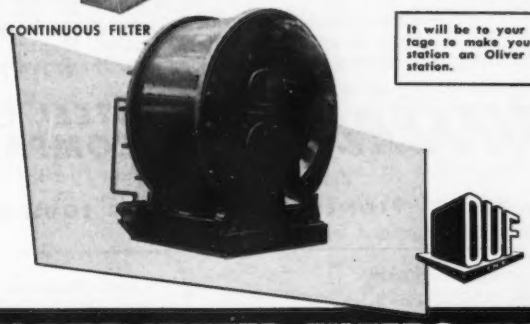

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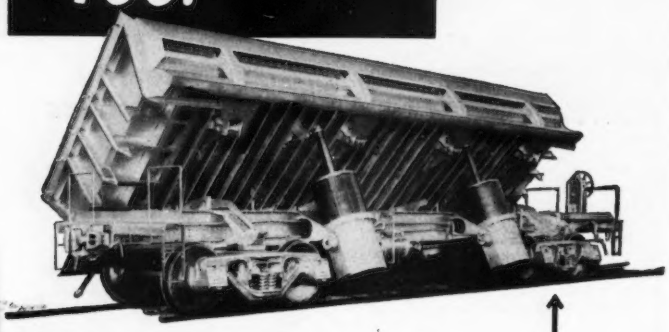

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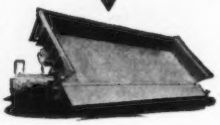

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SINCE 1915 — PIONEERS IN HAULAGE EQUIPMENT

Philippines *(Continued)*

tended to all areas when vein walls were strong but timbered cut and fill continued to be used for weak walls and wider veins. Pumping continued to be a major expense. About 40.5 tons of water were pumped for every ton of ore hoisted.

While mine conditions improved at the property in 1950, it is asserted that future profits are by no means assured because of legislation prompted by recommendations of the Bell Commission. The tax on corporate profits has been increased from 16% to 28% and an excise tax of 17% has been enacted on all foreign exchange purchased whether for imports of machinery and supplies or remittance of dividends. A minimum wage law will increase operating costs further. If it were not for the premium on gold sales, it is doubtful if the mine could do more than operate on a break-even basis.

★Philippine gold production for the first quarter of 1951 totalled over $3,000,000 in value, exclusive of by-product gold recovered from the Lepanto shipments of copper concentrates. As usual, the Benguet-Balatoc operations headed the list, followed by Mindanao Mother Lode, Atok, and Surigao Consolidated in order.

IN AUSTRALIA

★**Australian gold production** in January was 67,835 oz., an increase of 3.7% over January, 1950. This is the first major upturn since the 1949 currency devaluation bumped up the local gold price by 44%. For the year 1950 output was 3.9% lower than for 1949.

★Price control authorities have refused to raise the ceiling on Australian-produced tin above 84c. per lb., but producers will receive an extra 16c. from a pool established early this year to supply consumers of domestic and imported tin at a uniform price. Zinc and lead remain pegged at 6.5c. per lb., with no provision for such a bonus.

NORTHERN TERRITORY

★The Administrator of the Territory, in his latest annual report, sounds a warning that the recent buoyancy of **gold production may not be sustained** for many years as 95% of the gold comes from the same four mines. Production of 22,290 oz. in 1948-49 (the period covered by the report) contributed 53.4% to the total value of minerals produced. The four mines mentioned in the report are **Noble's Nob, Skipper Extended, The Eldorado,** and **The Whippet.** Only Noble's Nob is assured of a sound position for some years while the other three have either no ore reserves on hand or are falling back on lower grades.

★A diamond drilling campaign was being continued on the Warramunga field by the **Northern Consolidated Development Company.** Two companies were formed during the year to develop leases at Tanami.

★Copper ore production forged ahead to take second place after gold. The ore came from the **Home of Bullion Mine** at Barrow Creek and from the Jervois range. Production was 2,885 tons valued at £91,933 compared with 119 tons worth £4,175 in 1947-48. At the Australian selling price ruling in 1948-49, the value represented about 540 tons of copper. The Territory also produced 41.6 tons of trimmed mica, 60.6 tons of tungsten concentrates, and 28.5 tons of tin concentrates.

★**Australian Development,** at Tennant Creek, has hit the headlines with another rich crushing which yielded 6,100 oz. from 993 tons of ore. This included 67 tons of ore from a winze chamber at the 215-ft. level which yielded 4,000 oz. The mine so far has won 26,600 oz. from 57,000 tons of ore.

WESTERN AUSTRALIA

★**A substantial fall** in the State's gold output was unavoidable unless inflation could be checked or the U. S. gold price raised, declared the chairman of Golden Horseshoe (New), Ltd., in his annual address to stockholders. The company earned £97,675 stg. (last year £101,296 stg.) from treatment of the Boulder Perseverance No. 2 dump.

★**In the year ended March 31, New Coolgardie** treated 41,127 tons of ore for a recovery of 20,188 oz. This is a notable improvement on the previous year's crushing of 31,454 tons for 13,283 oz. Average four-weekly throughput increased from 2,420 to 3,163 tons due to admixture of more hard ore, mainly from the Callion mine, to facilitate milling of the oxidized ore from the Surprise mines.

★**Paringa Mining & Exploration** is expected to show a loss of about £35,000 stg. after making allowances for mine development and depreciation. Milling was suspended in January because of losses incurred through low-grade ore and spiraling costs. Resumption of milling will depend on the results of geological investigations and underground diamond drilling tests.

★**Gold Mines of Kalgoorlie** showed improved results for the year ended March 31. The mine produced 42,614 oz. from 163,115 tons of ore compared with 41,337 oz. from 163,182 tons in the previous year. But Central Norseman, in the same group, reported a drop in yield from 44,779 oz. to 41,880 oz. although ore throughput rose from 137,689 tons to 153,928 tons.

★**Mountain View Gold's profit** for the year ended November 30 last fell sharply to £4,148, from £37,332 in the preceding year. The mine produced 2,212 oz. of gold by amalgamation and 434 oz. from sands and concentrates. Ore reserves are estimated at 6,700 tons of 10 dwt.

VICTORIA

★**Morning Star Mines,** the State's leading producer, treated 15,902 tons of ore for a recovery of 11,566 oz. in the year ended March 31. This compares with 19,919 tons and 15,492 oz. in the preceding year.

★**Central Nell Gwynne,** Bendigo, has decided to go into voluntary liquidation. The crushing battery has been sold to Wattle Gully Gold Mines.

★Stockholders of **Northern Star Gold Mines N.L.** have approved an increase in the company's nominal capital by raising the amount of each of the 60,000 issued shares from 10 shillings to £1. The additional capital is required for acquisition of plant to cope with increased throughput. At present only one underground party is employed, but it is planned to open up

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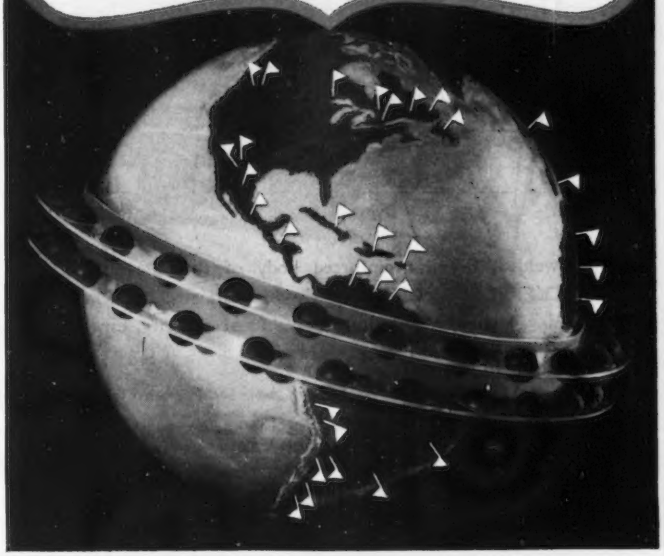

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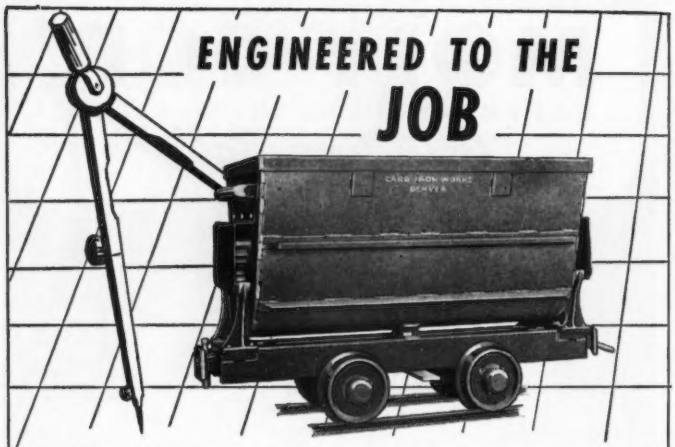

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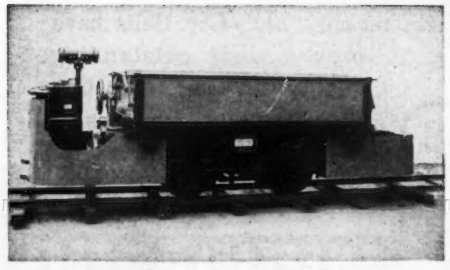

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Victoria *(Continued)*

several working faces.

★Directors of **Mt. Todd Gold Mine N.L.** have decided to sell the mine's assets. Since the plant closed down it has been found impossible to obtain skilled labor to resume operations.

★In the four weeks ended February 10, **Aberfoyle Tin** milled 2,776 tons of ore for 40½ tons of tin concentrates, 12 tons of wolfram concentrates and 15½ tons of wolfram residues. To attract men to the mine and make them stay, Aberfoyle Tin is building cottages and selling them to employees at cost on a slow amortization plan. No charge is made for interest on the outstanding balance. The company reports reduced absenteeism, more men offering for work, and less turnover of labor as a result of the home-building program.

NEW SOUTH WALES

★**Western Gold Ltd.** has been incorporated in Sydney with a capital of £50,000 to acquire and unwater the old Ironclad mine at Cargo. The mine was worked 75 years ago by an English company and developed to 470 ft. The ore assayed 3 to 7 oz. per ton, but could not be treated satisfactorily by the chlorination process and the mine closed down before the turn of the century. Western Gold intends to sample the orebody after dewatering the workings. The company has also secured an option over old tin areas at Gundle on the north coast of the state. These leases were worked for about fifteen years until 1907 and interest in them was revived in recent years by discovery of several rich ore shoots.

NEW ZEALAND

★A laboratory-size wet magnetic separator for strongly magnetic mineral sands has been constructed by the Dominion Physical Laboratory. A very simple wet feed was devised to produce six tons of concentrate on a rated throughput of 280 lb./hr. A Humphreys spiral was employed to remove much low-density material from a particular beach sand, and the high-density fraction, consisting of magnetite, ilmenite and garnets in roughly equal proportions was fed directly to the separator as pulp. The feed arrangement consisted of a flat-bottomed galvanized iron chute inclined beyond a particular critical angle. The chute was so arranged that the sheet of pulp impinged on the separator belt in the middle of the high-density flux region between the lowest and next series of diamond-shaped pole shoes. The magnetic sand grains tended to form a continuous magnetic curtain falling onto the

belt, with a large proportion of the gangue swept away by the downward drag of the main water stream before it reached the belt. This simple device greatly increased the capacity of the separator and made its operation continuous and automatic. The separator was employed in the preparation of six tons of concentrates used in recent New Zealand experiments on steel making from magnetic sands. Though the trials were satisfactory, the government has indefinitely postponed further work on the steel-making project.

TASMANIA

★In the recent 38 weeks, **Aberfoyle Tin** earned more from wolfram than from tin. In the same period of 1949-50, wolfram sales accounted for only 21 per cent of the total output value. Higher tungsten prices, combined with an output increase, brought about this shift.

★**King Island Scheelite,** Australia's largest producer, reported a record output for the four-weekly period ended April 7. The company treated 14,267 tons of crude ore for 73.62 tons of scheelite concentrates, presumably in terms of a concentrate grade of 65% WO_3.

★**Montana Silver-Lead N.L.** has taken out a free inspection option over a tin-tungsten-bismuth mine in the Moina district. A production of 476 tons of wolfram concentrates has been recorded from the district up to the end of 1948. The principal mine, the Shephard and Murphy, has been closed for many years. The possibility of reopening it was examined during the last war and is now again under investigation by Montana Silver-Lead. If reopened, the mine is thought capable of producing up to 50 tons of wolfram in addition to tin and bismuth concentrate.

QUEENSLAND

★**Mount Morgan,** is now investigating sulphur dioxide treatment of slime pulp. Tests on the burnt slime fraction of the ore have indicated a material improvement in concentrate grade as a result of preconditioning with SO_2 gas. The process is to be adopted on a plant scale. Finer grinding as a means of improving metal recoveries has also been investigated with positive results. Plant scale tests will be undertaken shortly to test its economics. Mount Morgan is also experimenting with Heavy-Media separation to effect economically useful concentrations of sulphur. The company is planning to extend the open-cut for the working of 1,900,000 tons of sulphide ore. A 5-cu. yd. shovel is on order. Reserves of this ore are 4,830,200 tons assaying 3.97 dwt. gold and

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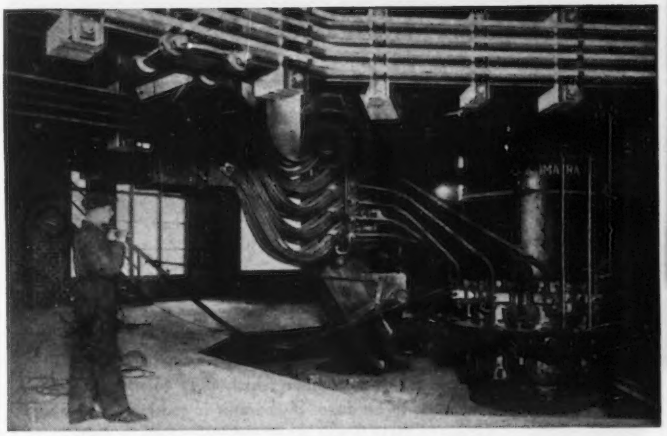

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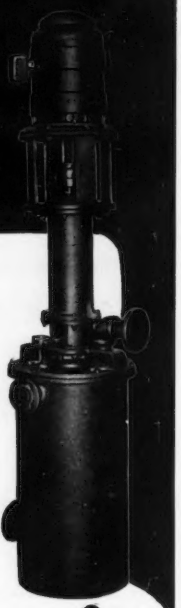

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IN AFRICA

★Shaft sinking crews of **Virginia Orange Free State Gold Mining Co.** in which **Kennecott Copper** has an interest, continue to set new records. In March they sank, and concrete-lined, their No. 3 shaft a total of 407 ft. In April, they put the shaft down 504 ft. for a total depth of 1,054 ft. Sinking began on Feb. 27. The previous record was held by van Dyk mines on the Rand, which put down 461 ft. of unlined, circular shaft in one month. The rapid progress of the Virginia group in sinking a lined shaft is owing to use of a new technique involving a two-tier Galloway stage, which enables the walls to be concreted uninterruptedly, while drilling and blasting go on below.

★**South African gold mines** received £1,937,977 in the first quarter of 1951 for gold sold at a premium (for "industrial and artistic purposes"). The total sold in this manner during 1950 was £2,123,547. Leading the list was Daggafontein with £126,706 from the premium market. Meanwhile the Secretary of the Rhodesian Chamber of Mines has told the International Monetary Fund that unless the IMF agrees to let Southern Rhodesia's small mines sell their gold at a premium, too, most of them will have to close.

★**Free State Geduld Mines, Ltd.** will go ahead with its No. 2 shaft in the Orange Free State to the full depth of 5,600 ft., and will not stop at an intermediate point for development work. At first, the intention had been to stop at 4,200 ft. and drive over to pick up the intersection of borehole No. 1 with the Basal Reef. This was the borehole that started **such wild excitement** in 1946 with a core that asayed 3,377.5 dwt. over a width of 6.8 in. Instead of using full concrete lining, the company is now supporting shaft steelwork with horizontally-reinforced concrete strips. This has improved the sinking rate in both No. 1 and No. 2 shafts, and other shaft-sinking crews in the Anglo-American group have adopted the method.

★**West Driefontein Gold Mining Co.** and Stilfontein Gold Mining Co. have agreed to build plants to extract uranium from their slime tailings. The new plants are expected to begin operating in 1953. They have contracts to sell their production to the Atomic Energy Board of South Africa for the next ten years.

NEW BOOKS

Diamond Drill Handbook. By James D. Cumming. One of the most comprehensive volumes on the subject, prepared for engineers, geologists, students, mine managers and exploration companies. Chapters cover data on the diamond; diamond drill bits; mechanical details of drilling equipment; drill cores and sludge; problems of cementing, casing, water supply; blast-hole drilling; wedging devices; directional drilling; surveying; contracting; costs and statistics; data on U.S. and Canadian metric standards for diamond core drill fittings. Copies of the handbook may be obtained from the following offices of J. K. Smit and Sons, Ltd.: 129 Adelaide St., West Toronto, Ontario, Canada; 157 Chambers St., New York 7, N. Y.; 22-24 Ely Place, London, E.C. 1, England. Pp. 500. Price $6.50.

Cost Accounting for the Mining, Concentrating, and Smelting Industry. By Crawford C. Halsey, Certified Public Accountant. Chapter in the Handbook for Cost Accounting published by D. Van Nostrand & Co., Inc., 250 Fourth Ave., New York, N.Y. This is a comprehensive illustrated summary particularly adapted to large mining organizations, but of value also to medium-sized operations. While the chapter is addressed primarily to setting up a cost-accounting system, it would be of interest also as a check against systems in use.

Statistical Summary of the Mineral Industry Including Production, Imports, and Exports. Compiled by the British Colonial Geological Surveys, Mineral Resources Division. Published by His Majesty's Stationery Office, 429 Oxford St., London, W.1, England. An excellent statistical summary of all minerals from abrasives to zirconium minerals. Statistics are presented for the years 1942 to 1948 inclusive. Production, exports, and imports of all nations of consequence are included. Pp. 340. Price £1 5s. Od. net.

The Behavior of Engineering Metals. By H. W. Gillett, Battelle Memorial Institute. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. This book expresses the viewpoint of the metallurgist for those who have not specialized in this field. It is designed to aid in the selection of proper engineering materials. Pp. 395. Price $6.50.

Plant Layout. By Randolph W. Mallick, Executive Staff Engineer, Westinghouse Electric Corp., and Armand T.Gaudreau, management consultant. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N.Y. This practical book, written for the executive and plant engineer analyzes and illustrates the fundamentals of good plant design. Although not dealing specifically with mine plant design, it

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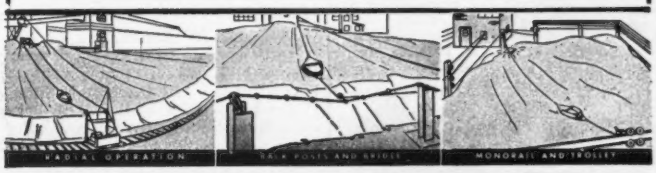

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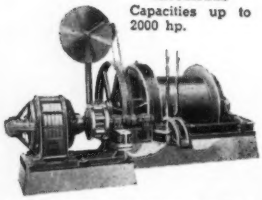

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Strength of Materials. By Ferdinand L. Singer, Associate Professor of Engineering Mechanics, New York University. Published by Harper & Bros., New York, N.Y. A thorough textbook covering the analysis and design of members subjected to various combinations of loading including axial, torsional, and flexural loadings. Pp. 469. Price $5.00.

Geology and Barite Deposits of Del Rio District, Cocke County, Tenn. By H. W. Ferguson and W. B. Jewell. Published by the Tennessee Department of Conservation, Division of Geology, Nashville, Tenn. Pp. 235 plus maps in pocket.

Detailed Geology of Certain Areas in the Mineral and Warm Springs Mining Districts, Blaine County, Idaho. By A. L. Anderson, T. H. Kiilsgaard, and V. C. Fryklund, Jr. Published as Pamphlet No. 90 Idaho Bureau of Mines and Geology, Moscow, Idaho. Pp. 73 plus numerous maps

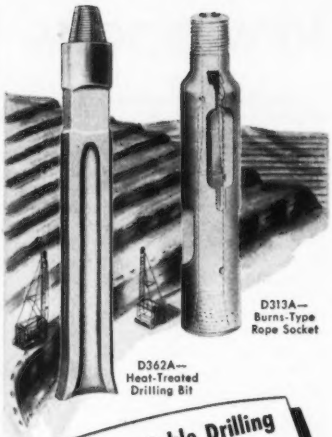
A Guide for Contracting of Construction and Related Engineering Services. This booklet tells you how to do business with the Atomic Energy Commission. It tells what AEC buys; who buys it; where procurement offices are located; and lists commodities purchased by or for AEC. This revised edition brings this information up to date as of March, 1951. For sale by Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Price 15c. and illustrations.

Eleventh Annual Report of the Chamber of Mines of Rhodesia. (1949) Published by the Rhodesian Technical Press, Ltd., Box 331, Bulawayo. Includes important mineral production statistics for Northern and Southern Rhodesia. Pp. 33.

Geology and Ore Deposits of the Highland Mountains, Southwestern Montana. By Uuno M. Sahinen. Published by the Montana Bureau of Mines and Geology, Butte, Montana. Pp. 63.

The Camp Creek Corundum Deposit near Dillon, Beaverhead County, Montana. By E. Wm. Heinrich. Published by the Montana Bureau of Mines and Geology, Butte, Montana. Pp. 20.

Metalliferous Mine Surveying. By Frederick Winiberg. Third revised and enlarged edition by G. A. Whitworth, A. V. Paull, and F. B. Michell. An excellent textbook with interesting chapters on new types of theodolites, field astronomy, tachometry (stadia work), orientation of underground surveys, surveying through inclined shafts, and stope surveying. Published by Mining Publications, Ltd., 482 Salisbury House, London Wall E.C. 2. Price 30s. Pp. 336.



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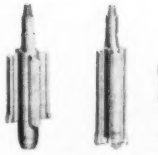

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The Geology and Mineral Resources of the Neighbourhood of Chegar Perah and Merapoh, Pahang. By J. A. Richardson. Published by the Geological Survey Dept., Federated Malay States. Price $6, Straits. Pp. 162 plus two colored maps.

Report of Conference on Silicosis and Aluminum Therapy. Jan. 30 and 31, 1950. McIntyre Research Foundation, 25 King St., Toronto, Canada. Mining readers will be interested in discussions of principles of exhaust ventilation, silicosis in South Africa, prophylaxis and treatment of silicosis, aluminum therapy in Mexico and disability evaluation. Pp. 74. Free.

Fluorspar Prospects of Montana. U. S. Geological Survey Bulletin 955-E. By Clyde P. Ross. For sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Pp. 50. Price $1.

Geophysical Abstracts 142, July-December 1950, U. S. Geological Survey Bulletin 976-C. For sale by Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Pp. 66. Price 25¢

The Australian Mineral Industry Review—1949. Published by the Bureau of Mineral Resources, 485 Bourke St., Melbourne C. 1., Victoria, Australia. Pp. 186.

Utilization of Texas Serpentine. By Virgil E. Barnes, D. A. Shock, and W. A. Cunningham. Published by the University of Texas, Austin, Texas. Pp. 52. Price 60¢

British Empire Trades Index, 1950. Over 65,000 business firms are classified under 3,500 separate trades. Published by Business Dictionaries, Ltd. (E. Dept.), 133 Fetter Lane, London E.C. 4, England. Price £1-10-0, or $5.

The Engineering Method. By John Charles Lounsbury Fish, Emeritus Professor of Civil Engineering, Stanford University. Published by Stanford University Press, Stanford, Calif. Students as well as practicing engineers will do well to master a system of logic and reasoning to be employed in solving engineering problems. This book concentrates on the "engineering method" which, if followed, will go far to establish such mastery. In fact, the training offered by this book should eliminate muddled thinking in

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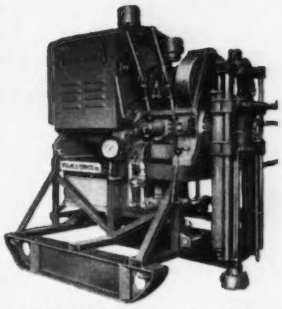

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Elements of Optical Mineralogy. Fourth Edition. Part II—Description of Minerals, With Special Reference to Their Optical and Microscopical Characters. By Alexander N. Winchell, Emeritus Professor of Mineralogy, University of Wisconsin, with collaboration by Horace Winchell, Assistant Professor of Mineralogy, Yale University. This liberally illustrated text offers a description of minerals whose optical qualities permit diagnosis by means of a microscope. It incorporates much information on crystals afforded by new developments in X-ray study of crystals. Few texts, if any, offer as much data on all minerals whose optical properties have been measured. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Pp. 531 including 427 illustrations. Price, $12.50.

California Journal of Mines and Geology. Vol. 46, No. 4. This pamphlet "Mines and Mineral Resources of Madera County, Calif.", "Mining Law in Recent Years", and "Quicksilver Deposits of the Cachuma District, Santa Barbara County, Calif." Published by the State of California Department of Natural Resources, Division of Mines, Ferry Bldg., San Francisco 11, Calif.

Bureau of Mines Releases

The following publications may be obtained from Bureau of Mines, Publication Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

I.C. 7586. Mining and Milling Methods at the Caselton Mine, Combined Metals Reduction Co., Pioche, Lincoln County, Nevada. By George H. Holmes, Jr. Pp. 24 plus 24 illustrations.

I.C. 7590. Carbon Dioxide Content of Mine-Fire Atmospheres as an Aid When Fighting Metal-Mine Fires. By S. H. Ash. Pp. 25.

R.I. 4744. A Thermal Decomposition Study of Colorado Oil Shale. By Arnold B. Hubbard and W. E. Robinsin. Pp. 24 plus 13 illustrations.

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R.I. 4749. Centrifugal Pump Installations in Anthracite Mines of Pennsylvania. By William H. Lesser. Pp. 22 plus 25 illustrations.

Geology of the San Dieguito Pyrophyllite Area, San Diego County, Calif. Special Report No. 4, by Richard H. Jahns and John F. Lance, published by the California Division of Mines, Ferry Bldg., San Francisco Calif.

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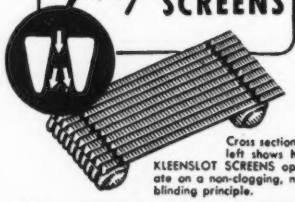

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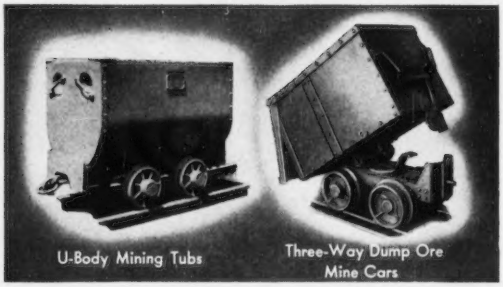

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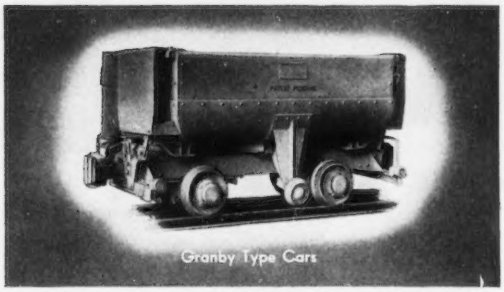

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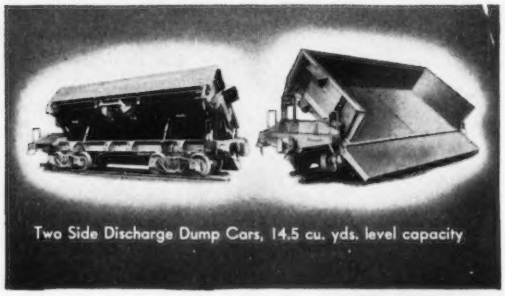

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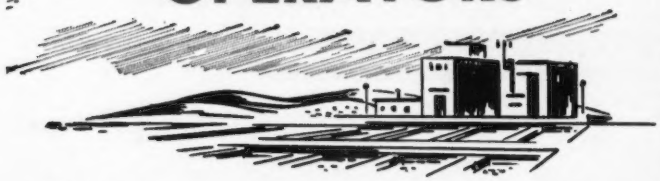

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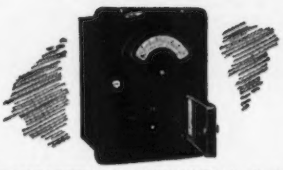
✱ The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*

✱ With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and continuously, if desired—on the process fluids themselves.

✱ Unique rugged-type Beckman Electrodes, specially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

Helpful Bulletin! *A Beckman Bulletin outlining interesting pH applications in the mining industry is available and will gladly be sent without obligation. Ask for pH data on mining applications.*

THERE'S A BECKMAN pH INSTRUMENT FOR EVERY NEED



COMPLETELY AUTOMATIC! The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*

PORTABLE A.C. OPERATION! The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v. 50/60 cycle A.C. current. Compact, convenient and extremely simple to operate, the Model H gives instant pH readings on an easily-read dial. It is widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.

COMPLETELY SELF-CONTAINED! The Beckman Model M is the ideal pH instrument where *complete* portability is desired. Operating from its own self-contained, long-life power supply, the Model M can be used *anywhere* in the plant or field, whether convenient to power lines or not. Features the same accuracy, simplicity and operating speed as the Model H, and is also widely used both for manual pH control of small plants and as auxiliary equipment on large automatic installations.

Write for literature on Beckman pH Equipment!

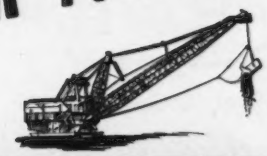
BECKMAN

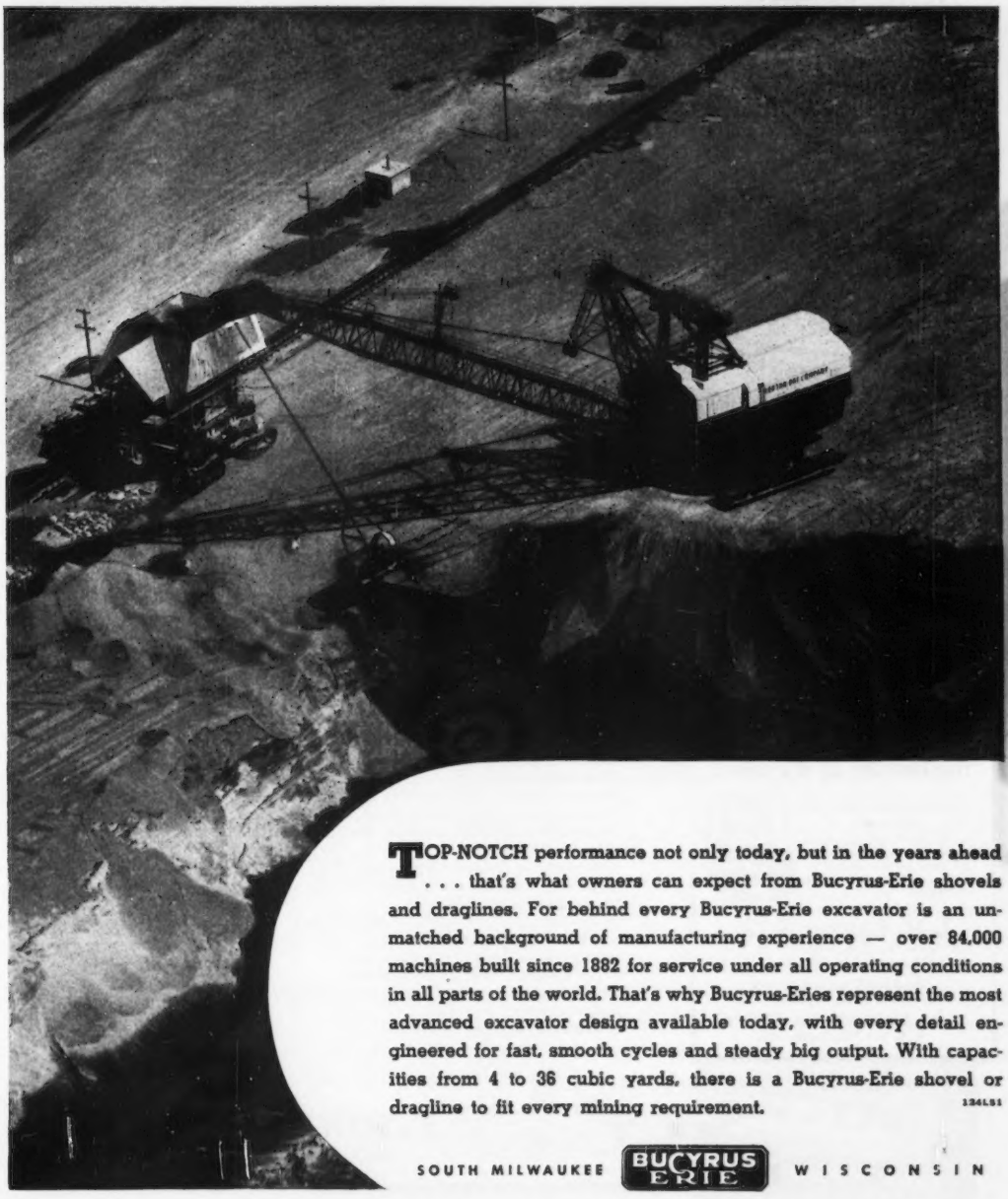
BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

BECKMAN INSTRUMENTS, Inc.
South Pasadena 27, California
FACTORY SERVICE BRANCHES: NEW YORK — CHICAGO — LOS ANGELES

INSTRUMENTS CONTROL MODERN INDUSTRIES

DESIGNED FOR TOMORROW





TOP-NOTCH performance not only today, but in the years ahead . . . that's what owners can expect from Bucyrus-Erie shovels and draglines. For behind every Bucyrus-Erie excavator is an unmatched background of manufacturing experience — over 84,000 machines built since 1882 for service under all operating conditions in all parts of the world. That's why Bucyrus-Eries represent the most advanced excavator design available today, with every detail engineered for fast, smooth cycles and steady big output. With capacities from 4 to 36 cubic yards, there is a Bucyrus-Erie shovel or dragline to fit every mining requirement. 134LS1

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I'm interested in safety and lower replacement costs. That's why—when it comes to *structural wood*—I always specify...

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- CHEMONITE gives permanent protection to all wood products.
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J. K. Smit manufactures the largest variety of diamond bits to give you the *lowest cost per foot* under all drilling conditions.

HARDHED matrix for the usual drilling conditions.

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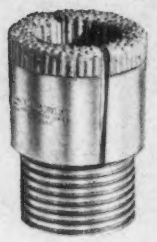
FERRET impregnated bits where this type gives better performance than surface set whole stone bits.

J. K. Smit engineers welcome the opportunity to discuss your drilling problems. Special equipment can be made to meet any unusual conditions.

Prompt Delivery • Prompt Resetting Service



J. K. SMIT & SONS

General Offices and Plant; Murray Hill, N. J.

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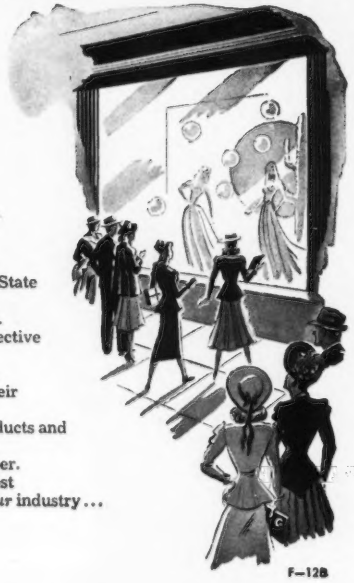
IF IT'S here...

IT'S news...

IT'S WORTH STOPPING TO SEE!

Maybe Industry doesn't maintain show windows on Fifth Avenue or State Street or Wilshire Boulevard like America's great department stores. But your industry has a mighty effective show window... *and this is it*... this magazine. In these advertising pages alert manufacturers show their wares. Here you will find up-to-the-minute news about products and services designed to help you do your job better, quicker, and cheaper. To be well-informed about the latest developments in *your* business, *your* industry... and to stay well-informed... *read all the ads too.*

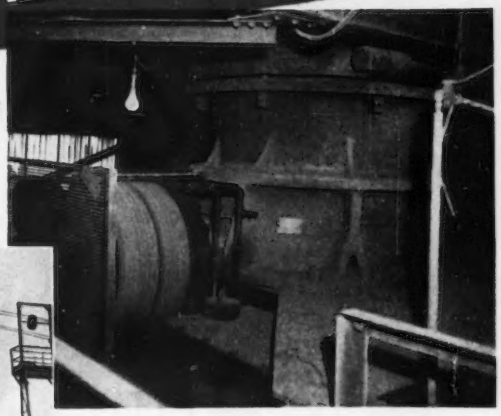


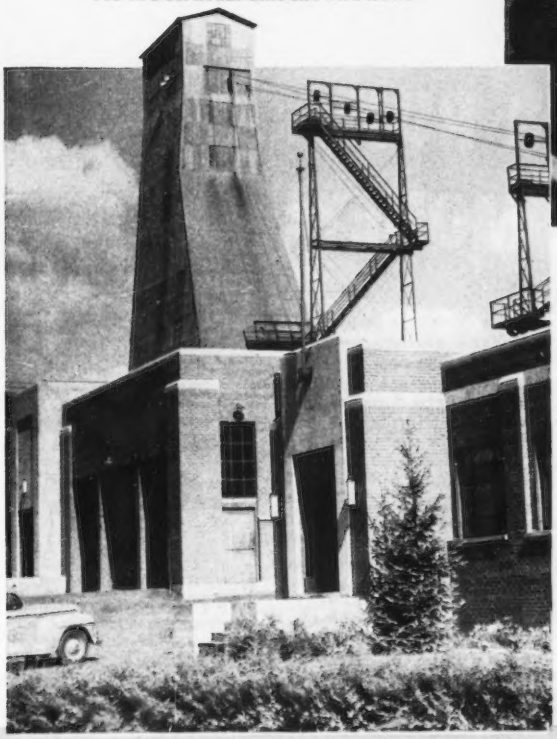
F—128

McGRAW-HILL PUBLICATIONS

OVER 3,000,000 TONS HAVE BEEN CRUSHED by this TELSMITH

The 13-B Telsmith Gyratory Crusher is located in the upper part of the 135-ft. steel headframe shown below.





● An important iron ore producer in the Iron River district of the Menominee Range in Michigan finds his Telsmith Gyratory Crusher to be exceptionally economical.

Installed in 1942, this Telsmith 13-B Crusher handles about 35,000 tons of ore per month, and to date has crushed over 3,000,000 tons. Crusher upkeep expense has been exceedingly low, consisting of only one set of eccentric bearings and some very minor parts. For details on Telsmith's bigger capacity and lower upkeep, get Bulletin 271.

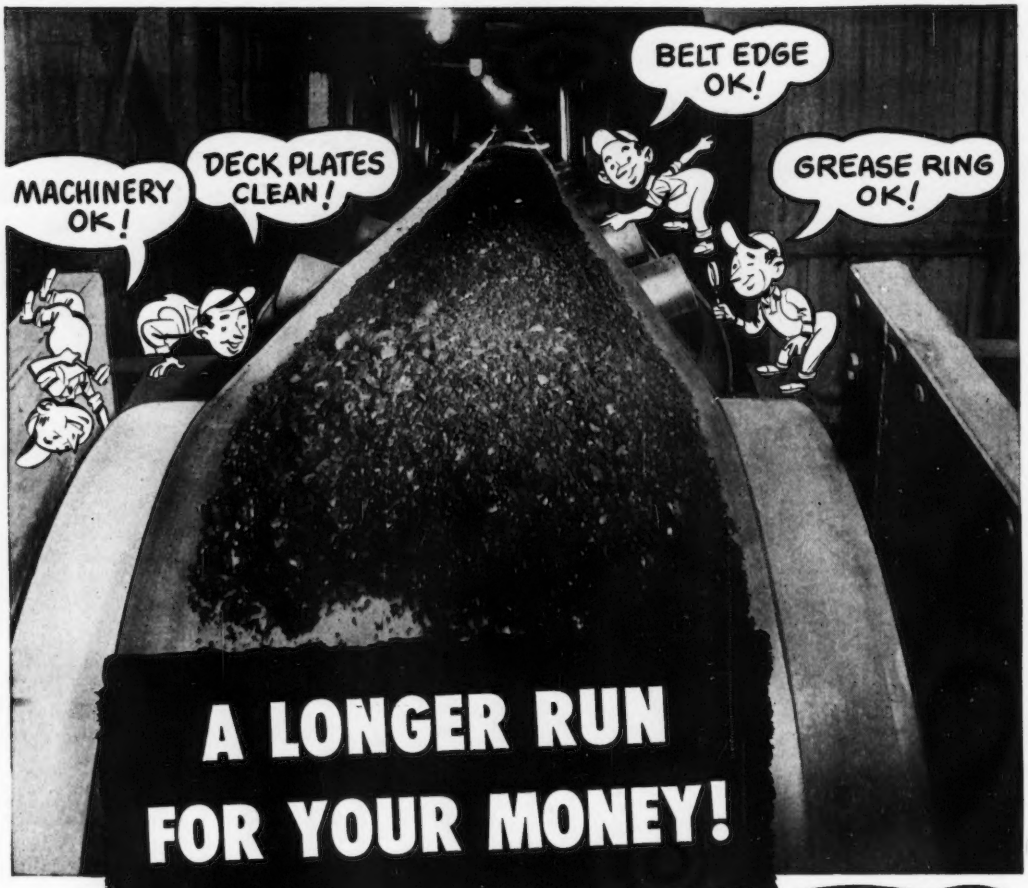
Min.-34

SMITH ENGINEERING WORKS, 502 EAST CAPITOL DRIVE, MILWAUKEE 12, WISCONSIN

Cable Address: Sengworks, Milwaukee

Samuel Osborn (S. A.) Ltd. Johannesburg, So. Africa — Armco International Corp. Buenos Aires, Argentina — 51 East 42nd St. New York 17, N. Y. — 211 W. Wacker Dr. Chicago 6, Ill. — Mine & Smelter Supply Co. Denver 17, Colo.

Mines Eng. & Eqpt. Co., San Francisco 4, Calif. — Mussens Canada Ltd., Montreal, P.Q. — Gordon Russell, Ltd., Vancouver, B. C.

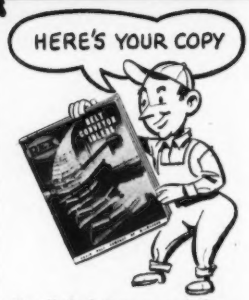


A LONGER RUN FOR YOUR MONEY!

Rex Idlers are built to last. Triple labyrinth grease seal . . . tapered roller bearings . . . extra large grease reservoir . . . these are a few of the Rex advantages that mean longer life for idlers, belts and machinery parts. Even if just one idler "freezes up," the belt can wear through the roll shell in a matter of hours, leaving knife-like edges to cut the belt. Rex Idlers are fully greased at the factory and will operate for long periods even without minimum maintenance. But Rex Idlers, or any other make, will give far longer service if minimum maintenance rules are followed. The fact that many Rex Idlers are still going strong after more than 25 years of service is, we believe, proof of the pudding.

Idlers, belts and machinery parts should be inspected periodically, depending upon amount of use. Greasing and servicing should be done as indicated by inspection. (Normally, 1000 operating hours is the average greasing period). Inspection should include the following checks:

1 All rolls turning freely and smoothly, with no excessive bearing end play.
2 All rolls properly seated in brackets.
3 No unusual damage to rolls, brackets or base.
4 Evidence of adequate greasing at seals but no excessive amount. Don't overgrease.
5 Check for accumulation of material under rolls. Keep deck plates clean.
6 No buildup of material on return rolls.
7 Grease pipes and fittings in good usable condition. No broken pipes or missing fittings.
8 Belt running true and self-aligning idlers operating freely.



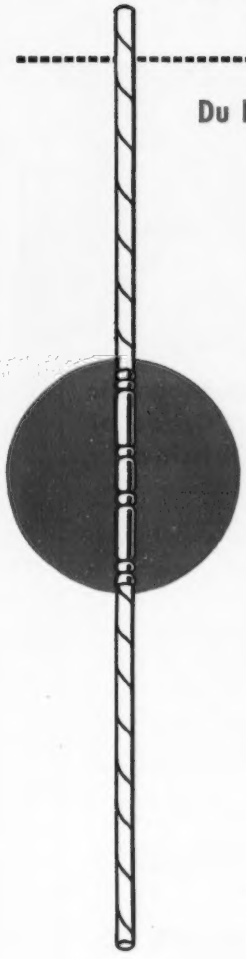
You'll find it pays to follow these tips. For more detailed information on idler care, approved idler greases, and for all the facts on the complete Chain Belt Idler line, send for Bulletin 463-R. Chain Belt Company, 1679 West Bruce Street, Milwaukee 4, Wis.

CHAIN BELT REX COMPANY

BELT CONVEYOR IDLERS

A NEW METHOD

OF SHORT INTERVAL DELAY FIRING FOR WELL DRILL BLASTS



Du Pont Primacord "MS" Connectors

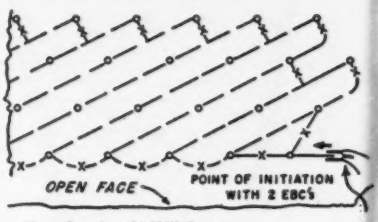
1. **Increase safety by eliminating electric blasting caps.**
2. **Allow unlimited flexibility in planning sequence-firing layouts.**
3. **Greatly simplify the hooking-up operation.**

Du Pont Primacord "MS" Connectors consist of a copper tube 2¾" long containing a delay element that creates an average interval of 16 to 17 milliseconds. At each end of the tube, a 12-inch section or "tail" of Primacord is crimped in place (see sketch at left). These sections are spliced or taped into Primacord trunk lines to provide any desired arrangement of delay firing. Electric blasting caps, either regular or delay, are entirely eliminated from the body of the shot. No caps are needed except for initiation of trunk line, and these are not attached until the shot is ready to fire.

The number of intervals possible is unlimited, and the new "MS" Connectors are readily adapted to a wide variety of blasting layouts. The typical multiple-row drill pattern shown at right provides sequence firing both for individual holes as well as rows. In this arrangement the shot is detonated at the open corner (point of greatest relief) formed by intersection of the face and the free end. Where ends of the shot are tight, the blast can be initiated at the center.

Hook-up operations are simple and fast. Du Pont Primacord "MS" Connectors provide the most convenient and fastest means yet devised for delay firing from the surface.

"MS" Connectors are proving a valuable addition to existing methods of surface initiation and in many cases will replace use of



x *Shows location of "MS" Connectors*

blasting timers and short interval delay electric blasting caps. The Connectors are now available in units of 25, packed in cardboard tube with screw top.

Ask your Du Pont explosives representative for additional information or write for Technical Service Bulletin No. 12. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

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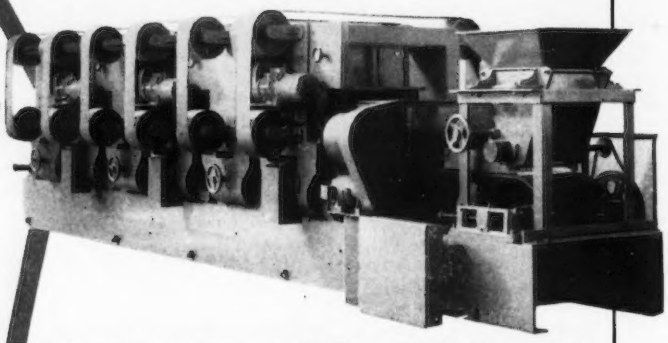
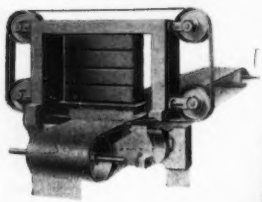
Hubnerite • Ferberite
Pyrrhotite • Manganese
and similar weakly magnetic materials





OPERATION: Material to be separated is carried on the main belt conveyor under a series of magnet and cross belt assemblies. Magnetic particles are attracted to the underside of the moving cross belt which sweeps them to the side to be separately discharged. Each magnet assembly can be adjusted to remove a desired magnetic fraction. Any number of cross belts depending on the number of materials to be separated can be provided.

Dings New Cross-Belt Type EBK Magnetic Separator Produces Highest Grade of Magnetic Concentration Obtainable

MORE selectivity and greater capacities in the concentration of magnetic ores than were heretofore possible are now obtainable with the new Dings Cross-Belt Magnetic Separator. Here are typical examples: A tungsten mining company in N. Carolina recovers 98% of a 72.2% grade WO_3 in their hubnerite ore. In McCall, Idaho, a 6 Cross Belt unit produces 550 lbs. of monazite concentrate per hour at 99.1% purity from an estimated feed of 2500-3000 lbs. of sand per hour.

Improvements

GREATER CAPACITY. New pole nose construction gives separating capacity about double that of any previous design. *Hence with this improvement, a smaller, less expensive unit will often handle requirements.* For example, under certain conditions, a new 3 Cross Belt Unit installed to concentrate manganese will do the work of a 6-belt unit of the old design.

GREATER SELECTIVITY. Each Cross Belt assembly is individually energized. The ability to make an extremely fine adjustment to each Cross Belt without affecting any other permits a degree of selective separation not possible in previous machines. A variable speed main belt drive further contributes to extreme selectivity.

EASIER MAINTENANCE. Dust sealed, anti-friction bearings are used throughout. Cross belts can now be replaced without dismantling machine.

SIMPLER OPERATION. Only one adjustment—varying the air gap—allows unit to handle various rates and qualities of feed to effect a given separation. Turning a stud, calibrated in thousandths of an inch, adjusts the air gap. Previous settings can be duplicated in seconds.

Write for full details. No obligation.

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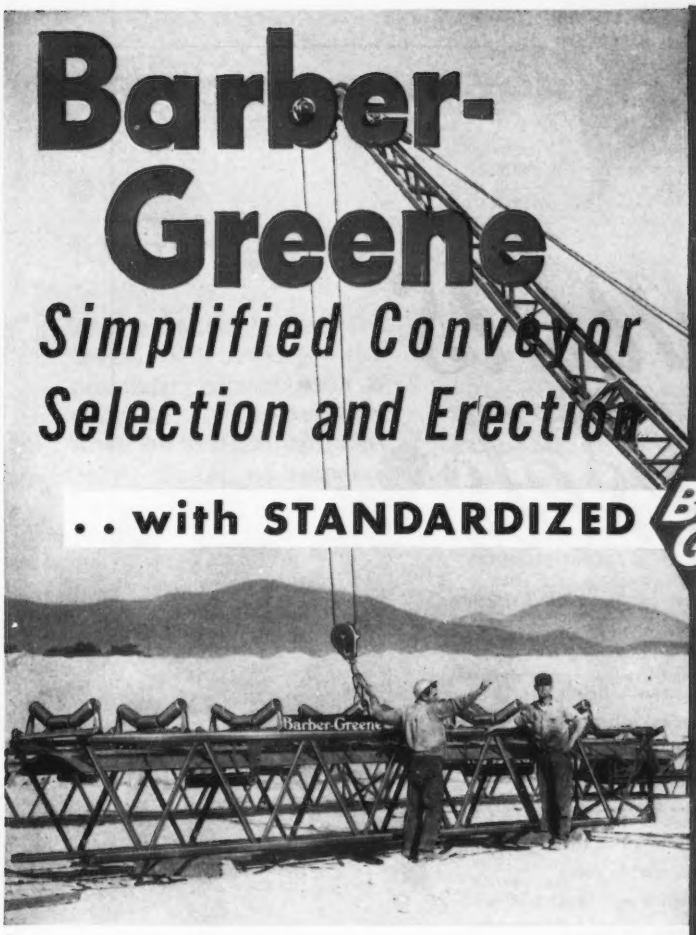
World's Largest Exclusive Builder of Magnetic Separators for all Industry

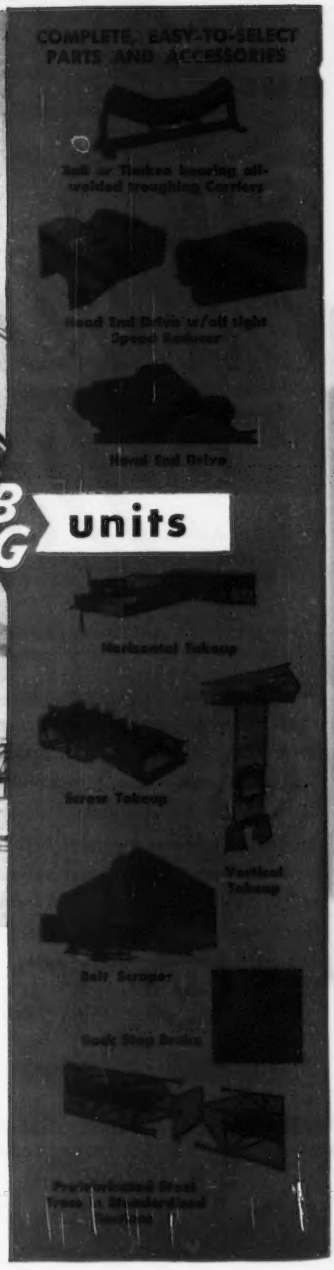
Certified Magnetic Strength

Barber-Greene

Simplified Conveyor Selection and Erection

. . with STANDARDIZED B G units



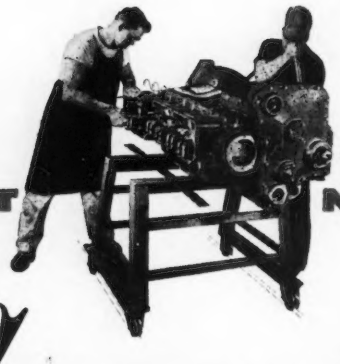


83

Barber-Greene Permanent Conveyors are complete, self-contained, *standardized* units that can be bolted together quickly . . . easily altered and moved. Field assembly of miscellaneous pulleys, bearings, and dozens of other parts is completely eliminated. The *pre-engineered*, factory-assembled terminals operate at top efficiency . . . reduce maintenance expense.

***Prefabrication* reduces manufacturing delays . . . permits our sales engineers to give you prompt quotations. *Standardized* construction and stocking of principal parts mean quicker delivery.**

Chances are, a B-G system offers possibilities you've never before realized. Let us show you how B-G Standardized Conveyors suit your specific needs.



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CUSTOM BUILT Diesels

Rugged, lightweight, high-speed Cummins Diesels perform better because they're custom-built to *fit each job.* And each engine is actually built twice. Assembled, run-in tested, disassembled, inspected . . . then reassembled and tested *again.* Precision building, Cummins exclusive fuel system . . . efficient service and parts organization, enable users to get peak performance, less "down-time" and *more* rugged, dependable power from Cummins Diesels. *See your Cummins dealer.*

Lightweight High-speed Diesel Engines (50-550 hp)
for: on-highway trucks
off-highway trucks • buses
tractors • earthmovers
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Case histories prove longer life

These actual service tests, involving the crushing of millions of tons of ore, represent data on which you can rely. Years of service have confirmed the results of this carefully-run test.

Case No. 1

Tests in Colorado between 1938-40: Molybdenite ore—quartz and feldspar, principal abrasives.

Service: Marcy 9′ × 9′ Trunnion overflow type ball mills grinding minus ⅜″ siliceous ore to 62% minus 100 mesh. Mill pulp density 75% solids. Mill speed 20 rpm: balls charged were 3″ dia.

Comparison: Under similar conditions, between two sets of manganese steel liners and six sets of high carbon chromium-molybdenum steel, (normalized and tempered to average 360 Brinell).

Liner type: Shell (Barrel liners), ship lap type; weight 33,500 lb. approx. per set.

Results:	*Hours in Service*	*Net Wear Lb/Hr**	*Per cent Scrap*
Manganese steel (average of two sets)	4979	4·59	34·2
Cr-Mo steel (average of 6 sets)	5561	3·97	34·3

* Net wear per hour represents metal actually worn away.

The manganese steel liners wore 16% faster than the chrome-molybdenum steel liners.

Case No. 2

Tests in Colorado, 1943: Molybdenite ore—quartz and feldspar, principal abrasives.

Service: Marcy 9′ × 8′ grate discharge type ball mills grinding minus ⅜″ siliceous ore to 55% minus 100 mesh. Mill pulp density 75% solids. Mill speed 20 rpm: balls charged were 3″ dia.

Comparison: Under similar conditions between two sets manganese steel liners and eleven sets of high carbon chromium-molybdenum steel, (normalized and tempered to average 400 Brinell).

Liner type: Shell (Barrel liners), ship lap type of special thin design for high capacity mill operation; weight 26,000 lb. approx. per set.

Results:	*Hours service*	*Net Wear Lb/Hr*	*Tons Ground*	*Net Wear Lb/Ton*	*Per cent Scrap*
Manganese steel (Average of 2 sets)	2441	6·14	209824	·0715	38·7*
Cr-Mo steel (Average of 11 sets)	3018	5·02	249002	·0616	42·8

* worn beyond desired limits.

The manganese steel liners wore 22% faster (per hour basis) or 16% faster (per ton basis) than the chrome-molybdenum liners.

Write for 32 pp reprint of an informative paper published by the Amer. Inst. of Mining and Metallurgical Engrs., giving results of wear tests on grinding ball materials—FREE!

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America's No. 1 Mine Car Wheel!

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FOR FASTER . . . CHEAPER HAULING

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FOR LESS MAINTENANCE . . .

With "Floater's" solid closed front hub, and back double seal, grease stays in the wheel, dust and dirt stay out. Often "Floaters" require greasing no more than once in five years.

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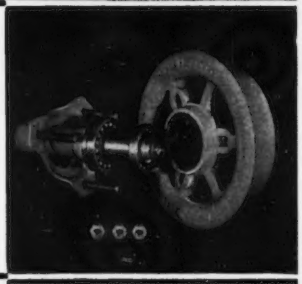
FOR QUICK DEMOUNTABILITY

Any unskilled worker can remove and replace a "Floater" as easily as changing an automobile wheel. Bearings always remain in perfect adjustment on axle. When replaced there's no chance of pinching, misalignment, loose or tight bearings.



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FOR LONGER WHEEL LIFE

We believe our own special mixture of iron and exclusive heat treatment are responsible for making "Floaters" famous for their toughness and long wear . . . such quality is your assurance of perfect satisfaction.

Try S-D "Floaters". Check their savings. Experience proves that once an operator knows what "Floaters" will do for him, he specifies smooth-running "Floaters" for all wheel replacements. For complete information, write Sanford-Day Iron Works, Knoxville, Tenn.

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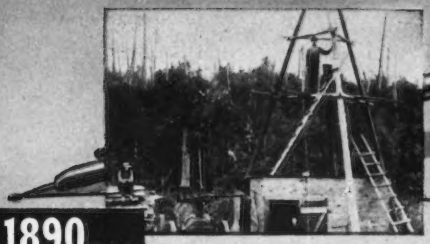
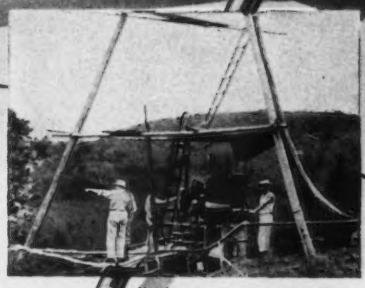
60 YEARS OF Longyear CONTRACT DRILLING SERVICE . . . 'round the world



1890... E. J. Longyear drilling first diamond drill hole on Mesabi Iron Range.



Longyear contract drilling crew in Venezuela.

1950.. exploring for iron ore in Canada with a Longyear UG Straitline Drill.

Today... There is immediate and urgent need for expanding known mineral deposits and exploring for new ones. Your goals can be met quickly and economically by using LONGYEAR Contract Drilling Service because . . .

1. You get dependable samples. Without them, drilling is a waste of time and money.
2. You get experienced crews trained in modern drilling techniques.
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SHAFT SINKING • GEOLOGICAL INVESTIGATIONS

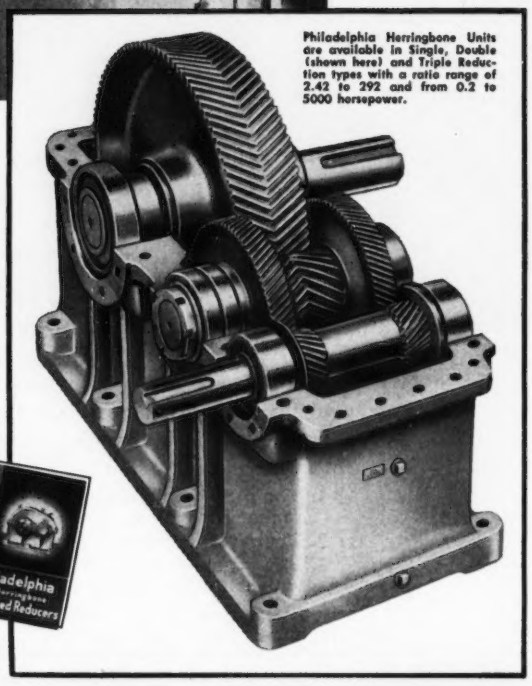
REPRESENTATIVES IN PRINCIPAL MINING CENTERS IN THE UNITED STATES AND OTHER COUNTRIES.

PHILADELPHIA HERRINGBONE SPEED REDUCERS

A Philadelphia triple reduction herringbone reducer at a Pennsylvania lime and stone company. Reduction ratio 48 to 1.

BALANCED DESIGN ➡ ➡
gives longer Service Life

The symmetrical gear arrangement of Philadelphia Herringbone Speed Reducers allows the bearing load to be equalized . . . an important factor in the longevity of these units. The two standard bearings on each shaft absorb an equal share of the gear load. In the Double and Triple types, double helical gears are spaced equidistant from the bearings in the first and intermediate reductions. A continuous tooth herringbone gear set on the centerline for final reduction completes the perfect balance that results in quiet, smooth, efficient operation.



Philadelphia Herringbone Units are available in Single, Double (shown here) and Triple Reduction types with a ratio range of 2.42 to 292 and from 0.2 to 5000 horsepower.

For complete construction details get our catalog H-49. Please write on your Business Letterhead.

Philadelphia Gear Works, INC.

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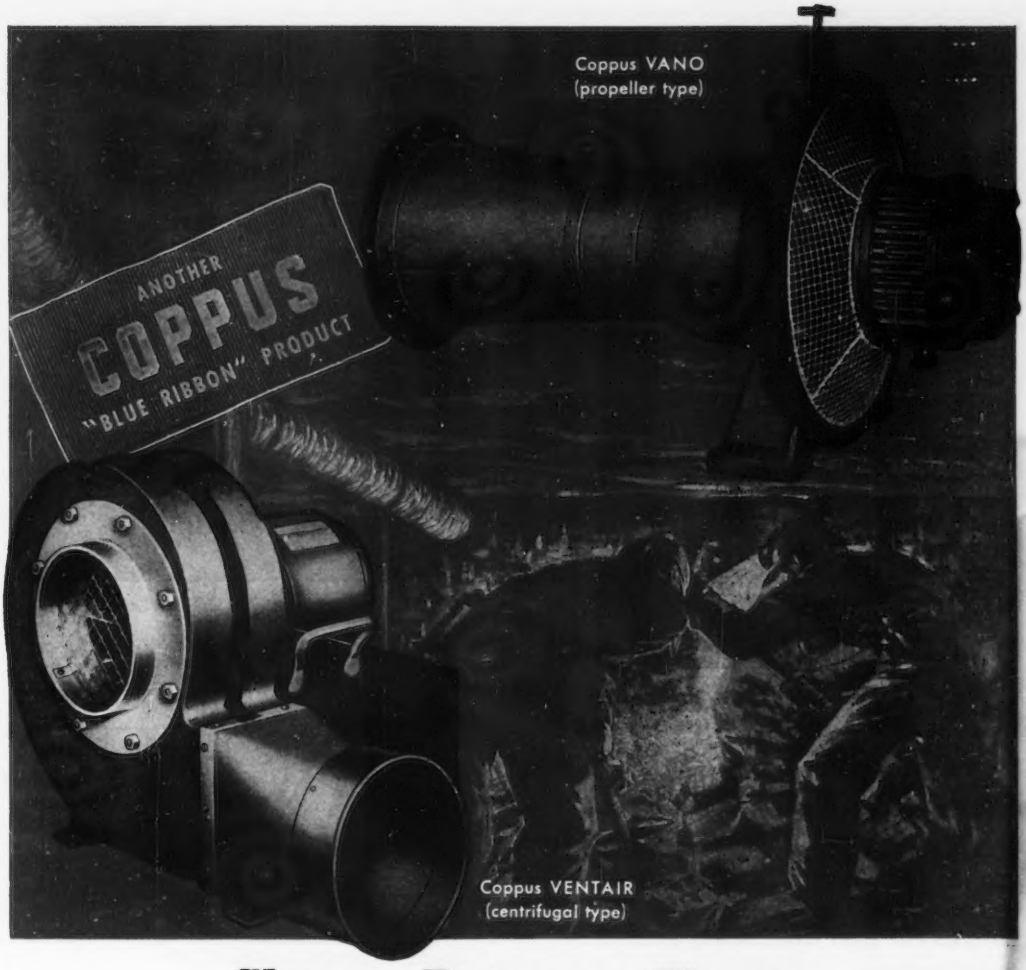
Industrial Gears and Speed Reducers
LimiTorque Valve Controls



Choose Between Them and Get 30% to 100% More Air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus **VENTAIR** is for long pipe lines; the propeller-type Coppus **VANO** for shorter lines . . . the correct selection will give you from ½ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

***Only** Coppus makes both these types,* one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER . . . Coppus Engineering Corporation, Worcester 2, Massachusetts.

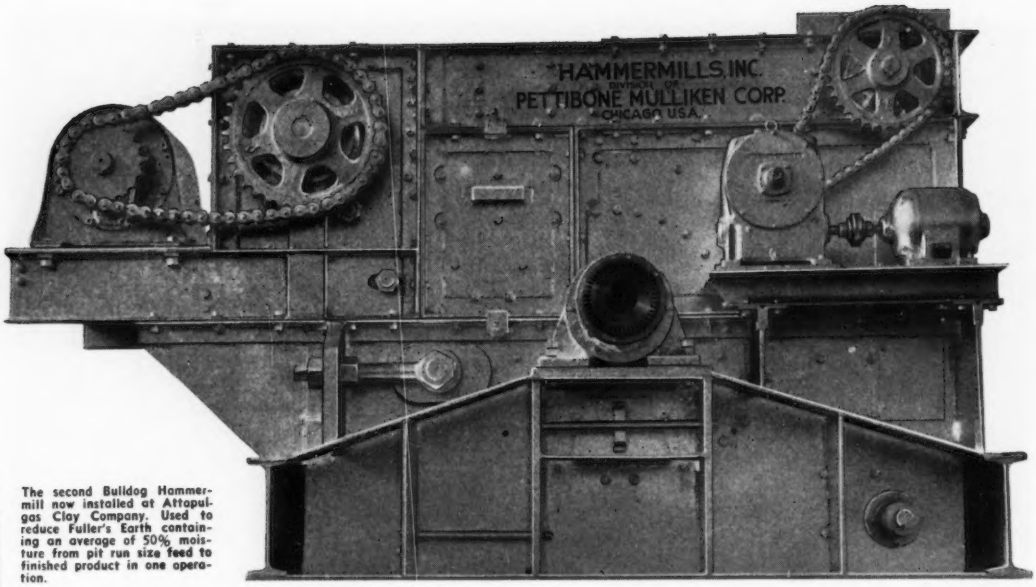
COPPUS ENGINEERING CORPORATION
286 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

Name .....

Company .....

Address .....



The second Bulldog Hammermill now installed at Attapulgas Clay Company. Used to reduce Fuller's Earth containing an average of 50% moisture from pit run size feed to finished product in one operation.

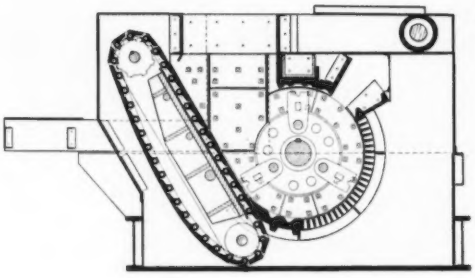
BULLDOG HAMMERMILL

with moving Breaker Plate

For wet, sticky material reduction . . . for those tough, heavy-duty crushing jobs.

Illustrated above is the last word in Moving Breaker Plate Hammermill design. It is built by an engineering organization whose experience far surpasses any organization that might furnish Moving Breaker Plate crushing equipment.

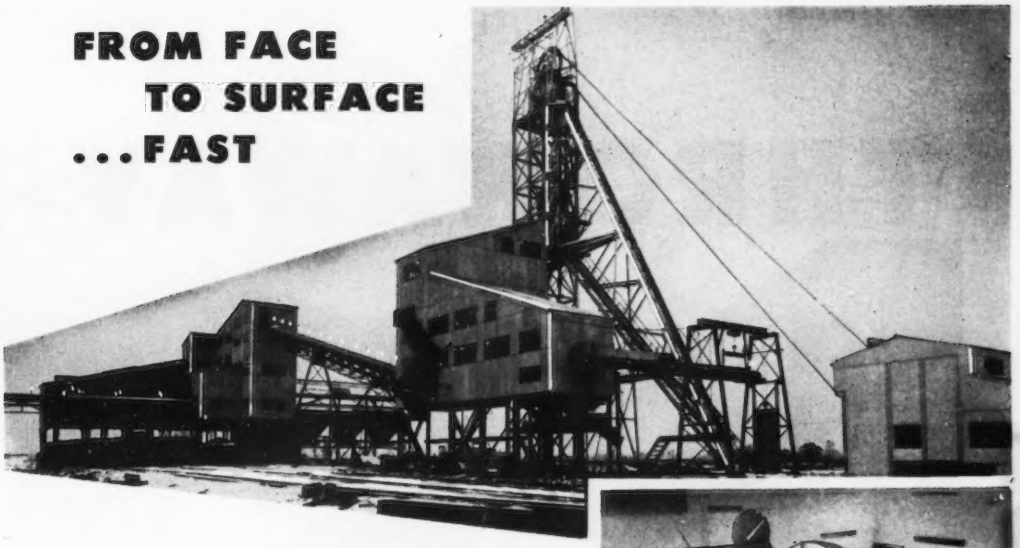
Design Improvements have increased reduction efficiencies and lowered H.P. requirements. You can see this equipment in operation at any time. Also Hammermills will gladly survey your reduction requirements and recommend the proper equipment without cost or obligation. Just write or call.

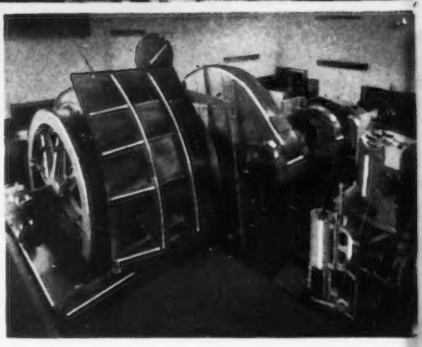


Bulldog Hammermills are built in capacities up to 1000 tons per hour for every purpose: for primary, secondary, fine reduction of materials such as limestone, shale, Fuller's Earth, phosphate muck, phosphate mud balls, iron ore, oyster or clam shells, any reducible material.

HAMMERMILLS, INC. • 4776 W. Division St. Chicago 51, Ill. • Phone Spaulding 2-9300 *division of* **PETTIBONE MULLIKEN CORP.** • 4700 W. Division St Chicago 51, Ill. • Phone Spaulding 2-9300

FROM FACE TO SURFACE ...FAST





Two-Speed Man and Material Hoist

Robert Holmes & Bros., Inc., built this 300 HP two-speed hoist and the head sheaves* for Peabody Coal Company's new Mine No. 17. This modern hoisting equipment, made for dual speed, fast operation and heavy duty service must have bearings that keep friction at the minimum, that are dependable, that are right for long-term service. Naturally, SKF Spherical Roller Bearings were selected for the main drive, drum and sheaves. Time and again SKF has demonstrated ability to supply just the right bearing for the right place—to help designers and builders of all types of equipment develop a better machine, a machine that functions smoothly and economically even under the roughest operating conditions. 7253

**For details on this hoist and other equipment, write Robert Holmes & Bros., Inc., 510-520 Junction Avenue, Danville, Ill.*

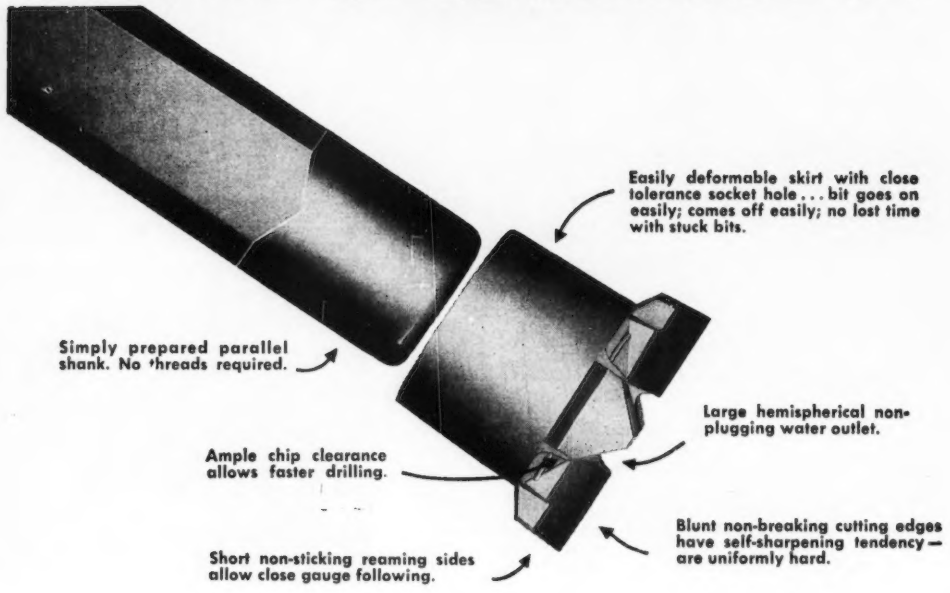
8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

integrity
craftsmanship
metallurgy
tolerance control
surface finish
product uniformity
engineering service
field service

SKF

SKF INDUSTRIES, INC., Phila. 32, Pa.
manufacturers of
SKF *and* HESS-BRIGHT *bearings*

THROWAWAY


Easily deformable skirt with close tolerance socket hole . . . bit goes on easily; comes off easily; no lost time with stuck bits.
Simply prepared parallel shank. No threads required.
Large hemispherical non-plugging water outlet.
Ample chip clearance allows faster drilling.
Blunt non-breaking cutting edges have self-sharpening tendency — are uniformly hard.
Short non-sticking reaming sides allow close gauge following.

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with

THE "ORIGINAL" ONE-USE BIT

Increased Rod Life with this Strongest and Cheapest Connection

Maximum Footage—Above Average Hardness

Minimum Breakage with Tougher Sockets

Made in All Gauges

THE "TEST" WILL PROVE ITS WORTH

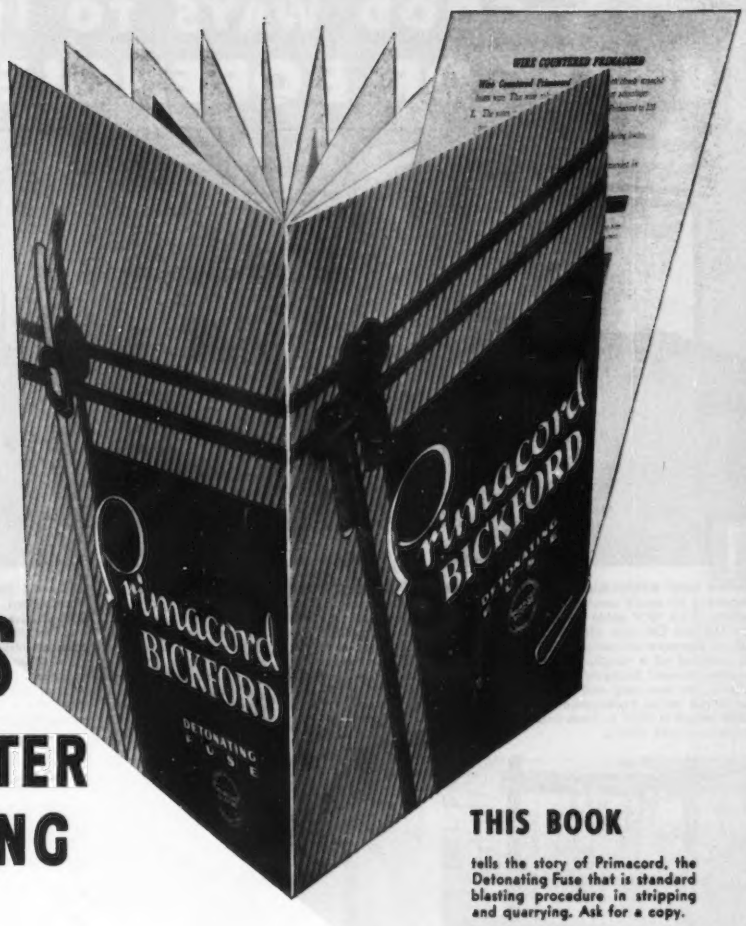
THROWAWAY BIT CORPORATION

4200 N.W. Yeon Ave. **Portland, Oregon, U.S.A.**

Fully descriptive literature on all products is available. Competent field engineers and dealers are always at your service.

Some territories still open for distributors and jobbers.

Four Brands FOR BETTER BLASTING



THIS BOOK

tells the story of Primacord, the Detonating Fuse that is standard blasting procedure in stripping and quarrying. Ask for a copy.

As shown on the booklet from left to right: Plastic Reinforced Primacord for very deep, wet holes, river crossings, etc. . . . Plain Primacord, for surface trunk lines and shallow holes . . . Reinforced Primacord for deep holes where extra tensile strength or resistance to abrasion are desirable . . . Wire Countered Primacord for deep, ragged holes and high abrasive conditions.

Choose the brand that meets your conditions and you will also choose safety, simplicity of hook-up, ease of use, freedom from the danger of stray currents, and best results from a minimum quantity of explosives.

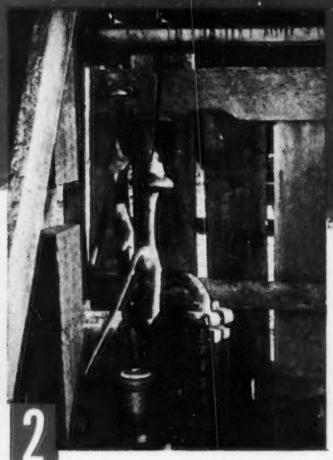
THE ENSIGN-BICKFORD COMPANY
Simsbury, Connecticut
Also Ensign-Bickford Safety Fuse — Since 1836

P-53

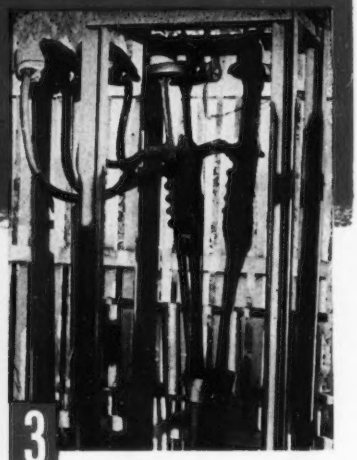
PRIMACORD®-BICKFORD Detonating •Fuse•

5 GOOD WAYS TO INSTALL SHAFT OR BOREHOLE CABLE

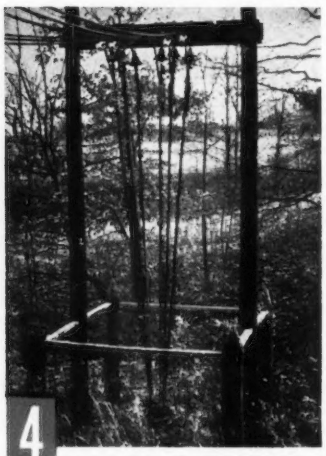
1 LIGHT-WEIGHT ALUMINUM BOREHOLE CABLE suspended by strain insulators clamped to conductors. This 5KV cable with ground wires is 3/c 350,000 CM with Hazard long-lived, high voltage Keystone oil-base insulation and an overall covering of a tough, moisture, flame, and weather-resistant Hazaprene ZBF Sheath. Borehole is 700 feet deep and carries a 2,300 volt a-c circuit to an underground rectifier station. Cable length is 1050 ft. from outside power line to underground station.



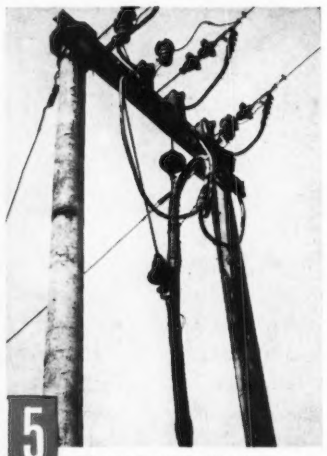
2 CONCENTRIC SHAFT-CABLE INSTALLATION 250-volt, d-c, 1,000,000 CM concentric cable suspended in conduit in shaft by means of I beams installed over shaft opening. Concentric conductor clamped, with copper strands bent back and refastened over clamp. Two 350,000 CM, 250-volt d-c cables also installed in shaft in conduit. These cables are supported from steel beams by strain insulators and clamps to conductors. All insulation is 600-volt Watertite with a protective sheath of Hazaprene ZBF.



3 4 CABLE INSTALLATION suspended from simple steel structure. Each cable is 500,000 CM, carries 550 volts d-c with two positives and two negatives. Conductors have Hazard moisture-resistant, 1000-volt, Watertite insulation. Unequalled outside protection against moisture, flame, acids and mechanical damage is provided by tough Hazaprene ZBF Sheath. Borehole is 500 feet deep with cables held by strain insulators and strain clamps on conductors.



4 SIX D-C FEEDER CABLES installed in a 600-foot borehole. Each cable is 250,000 CM, with 600-volt Watertite insulation and a tough Hazaprene ZBF Sheath. A strain insulator with clamp connected to the conductor supports these cables individually from simple steel structure.



5 4100 VOLT TRANSMISSION LINE to underground pumping stations and power-conversion stations for d-c haulage and mining equipment. Cable is a 3/c, 4/0, 5000-volt Hazard Borehole cable with long-lived Keystone oil-base insulation protected over-all by a Hazaprene ZBF Sheath. Suspension is accomplished by two strain insulators and Kellems grips.

HAZARD MINE POWER CABLES ENGINEERED FOR BOREHOLE USE GIVE YOU A DIRECT, TROUBLE-FREE, ECONOMICAL CIRCUIT TO UNDERGROUND WORKINGS

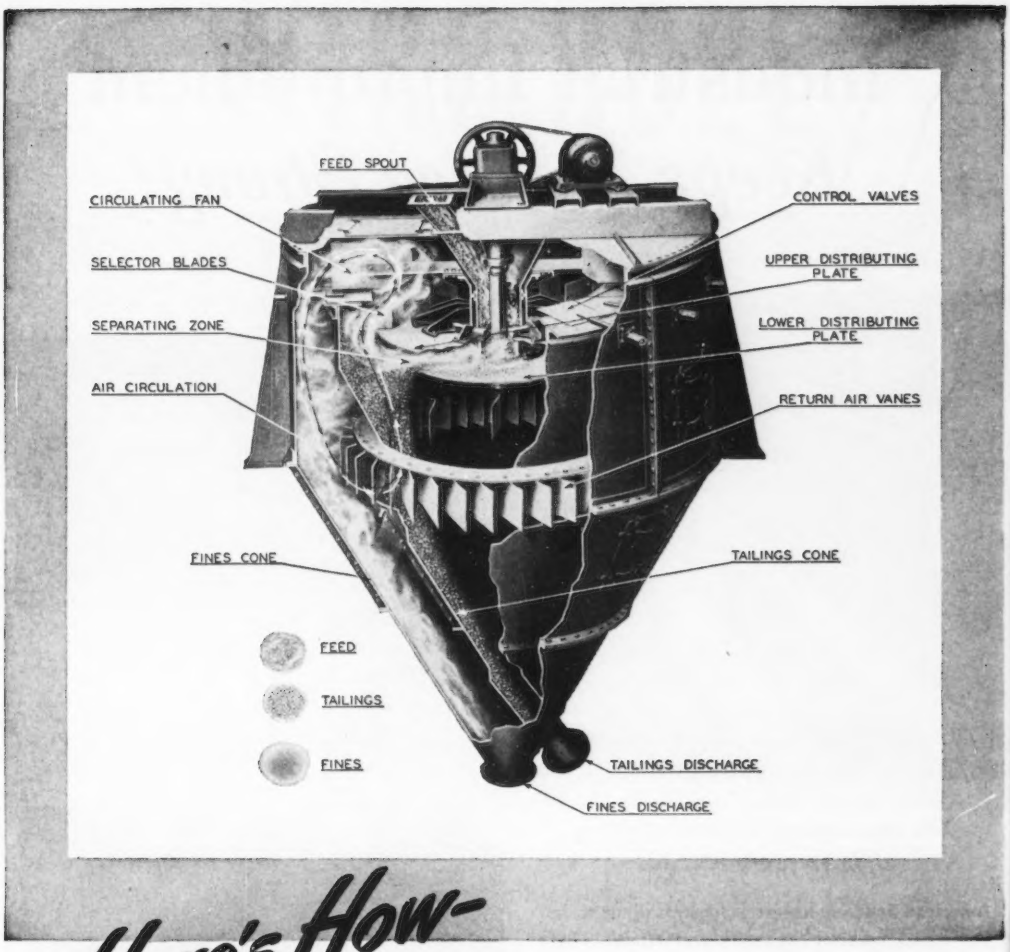
THERE are many good ways to install borehole or shaft cable, and on this page are shown some typical methods that have proved successful.

Of vital importance, of course, to any borehole or shaft installation is the design and construction of the cable used. And there is a wealth of first-hand experience in the selection of mine power cables readily available to you. Over the years, much Hazard research and engineering has been devoted to developing specialized mining cables—in cooperation with mining engineers — that simplify installation problems and costs . . . that assure long, trouble-free service.

An experienced Hazard engineer will be glad to discuss your own particular operating requirements with you. Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.

7725

HAZARD insulated wires and cables for every mining use



Here's How—

STURTEVANT AIR SEPARATORS

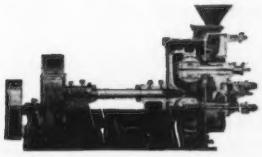
Produce accurate fines with increased output up to 300%

Exact regulation and control of centrifugal forces and air currents, one counteracting and overbalancing the other so precisely that by simple adjustments a product of almost any desired fineness is selected and collected, while coarser sizes are rejected . . . that's the principle of operation of Sturtevant Air Separators.

The benefits you derive from this separator are—increased output by as much as 25% to 300% . . . lower power costs by 10% to 50% . . . reduced maintenance.

A typical on-the-job example is as follows—a 16 ft. separator takes a feed of 750 tons per hour containing only a small percentage of the desired product and delivers 30 tons of material 90%, minus 200 mesh.

Investigate Sturtevant Air Separators today. Write for information and bulletin.



RING ROLL MILL

Capacities from 12 to 18 tons per hour. Range 10 to 200 mesh. Use this mill in closed circuit with Sturtevant Air Separators.

STURTEVANT
MILL COMPANY
101-A Clayton Street, Boston 22, Massachusetts
Designers and Manufacturers of
CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS
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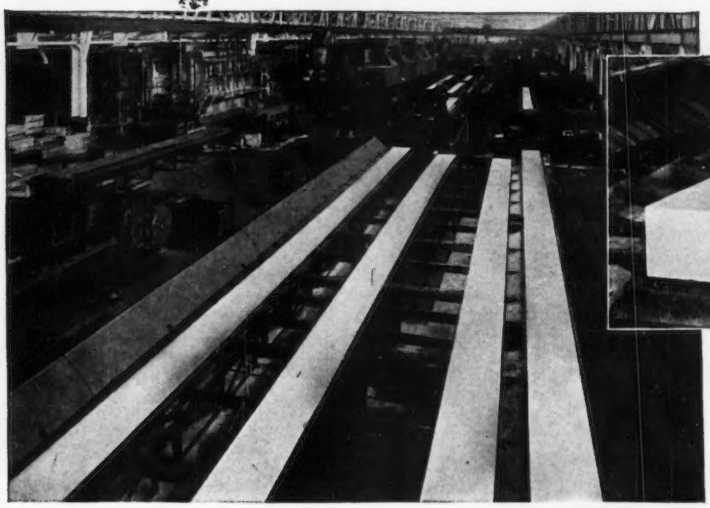
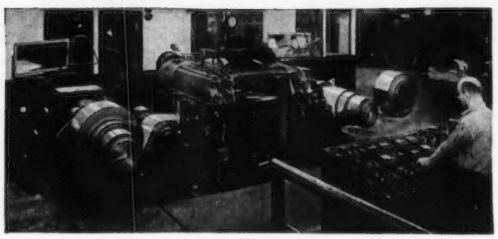
Industrial Improvement *Keeps America Strong!*



Above—3,300 lb. heated brass casting, ready for hot rolling. At left are shown the long brass bars after breakdown rolling.

Below—Finish rolling brass strip on new Sendzimir mill. Operating at high speeds, this mill produces bright, clean finished coils weighing up to 2,400 lb.



You don't defend freedom by sitting tight on your status quo

American Industry knows it must continue to improve and modernize, advance and expand. There is no other way to meet the grim challenge of mobilization.

The nation's metalworking industries have buckled down to the job of defense production. Anaconda helps them keep step with latest technical advances by continuing its intensive program of mill modernization.

One of the first projects completed in our mill improvement program is the new strip mill at the Buffalo Branch of The American Brass Company. This mill now produces longer and wider coils of brass strip from 3,300 lb. castings (13 times as heavy as could be handled before). These long, joint-free lengths of brass strip are made to remarkably close gage and have an exceptionally bright, clean finish.

Anaconda Copper, Brass and Bronze are in the front line of America's defense program. When world freedom and justice have been secured, these mighty metals will turn to peacetime tasks. Anaconda is thus serving tomorrow's needs as well as today's.

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Anaconda Wire & Cable Company
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Andes Copper Mining Company
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Roebling rope is the A-1 specification in the mining fields

FOR EASY HANDLING, extra toughness and service life, there's nothing like Roebling Preformed "Blue Center" Steel Wire Rope. "Blue Center" steel—made only by Roebling—gives rope top resistance to abrasion and fatigue. And Roebling Preforming gives you a rope that spools better... doesn't tend to set or kink... minimizes vibration and whipping.

There is a Roebling wire rope of the right construction, grade and size for every type and make of rope-rigged equipment. Have your Roebling Field Man help choose the rope that will give you the best, low-cost performance. Further savings may be effected by following his suggestions on installation, use and maintenance of wire rope. John A. Roebling's Sons Company, Trenton 2, N. J.

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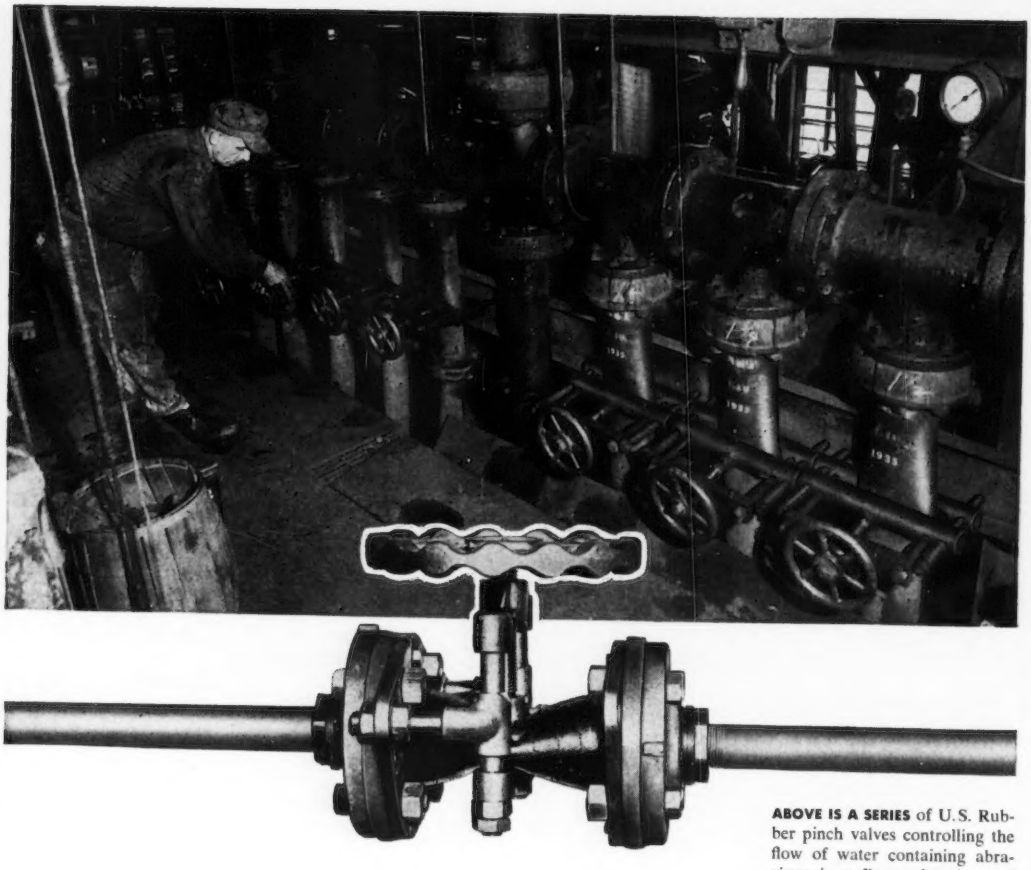
What does U. S. Rubber's pinch valve do for the coal industry?



ABOVE IS A SERIES of U.S. Rubber pinch valves controlling the flow of water containing abrasives in a Pennsylvania coal preparation plant. Many of them have been in continuous operation for over 16 years. Below the photo is the newest of the U.S. family of pinch valves, shown in a closed position. Sizes range from 1½ inches to 8 inches.

The new "U.S." pinch valve outwears metal when installed in pipe lines carrying abrasive or corrosive mixtures. Its flexibility offsets misalignment in pipes, absorbs vibration, breaks up galvanic action in pipes, eliminates "water hammer" and offers a positive seal in a closed position. The metal parts of the valve can be refitted to new valve bodies, thereby reducing replacement costs.

These valves are also available in neoprene for oil resistance, butyl rubber for high heat and severe acid conditions, and pure gum stock for food and beverage conveyance. Extremely compact design. Write to address below.

PRODUCT OF U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

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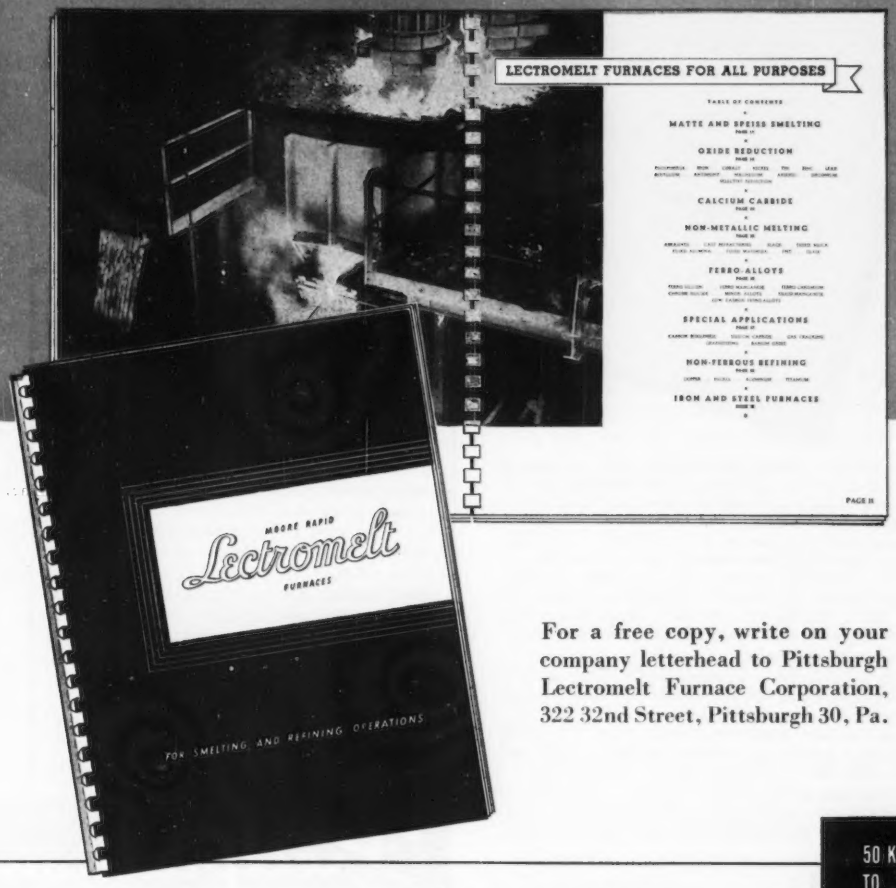
if you're interested in doing any of these things with an Electric Furnace,

you need this new book



For a free copy, write on your company letterhead to Pittsburgh Lectromelt Furnace Corporation, 322 32nd Street, Pittsburgh 30, Pa.

WHEN YOU MELT... MOORE RAPID *Lectromelt*

SEND FOR THIS 32 PAGE MULTICLONE BOOKLET

HELPFUL-INFORMATIVE IT OUTLINES THEORIES AND BASIC PRINCIPLES OF CENTRIFUGAL DUST RECOVERY!

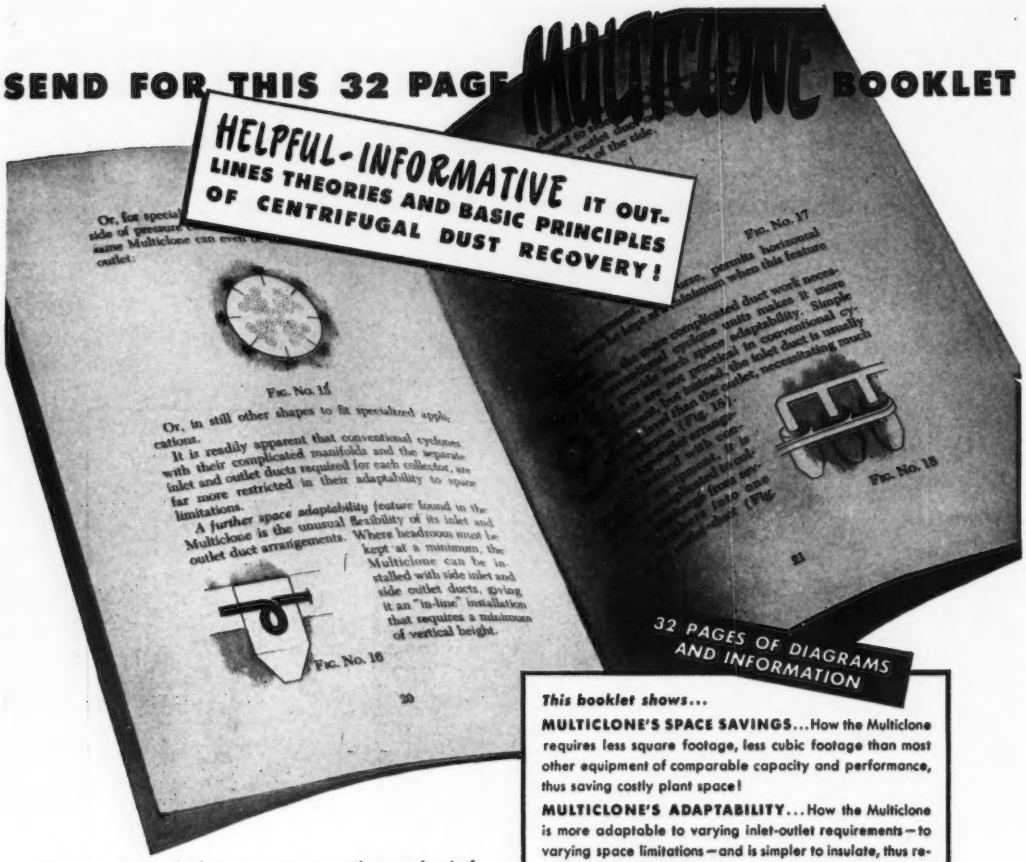


FIG. No. 15
Or, in still other shapes to fit specialized applications.
It is readily apparent that conventional cyclones with their complicated manifolds and the separate inlet and outlet ducts required for each collector, are far more restricted in their adaptability to space limitations.
A further space adaptability feature found in the Multiclone is the unusual flexibility of its inlet and outlet duct arrangements. Where headroom must be kept at a minimum, the Multiclone can be installed with side inlet and side outlet ducts, giving it an "in-line" installation that requires a minimum of vertical height.
FIG. No. 16
20
FIG. No. 17
FIG. No. 18
21
32 PAGES OF DIAGRAMS AND INFORMATION

This booklet shows...

MULTICLONE'S SPACE SAVINGS...How the Multiclone requires less square footage, less cubic footage than most other equipment of comparable capacity and performance, thus saving costly plant space!

MULTICLONE'S ADAPTABILITY...How the Multiclone is more adaptable to varying inlet-outlet requirements—to varying space limitations—and is simpler to insulate, thus reducing installation costs!

MULTICLONE'S EFFICIENCY...How Multiclone's multiple *small diameter* tubes, made possible by its exclusive vane design, give higher centrifugal forces and more complete cleansing of *all* suspended particles—even small ones of 10 microns and less!

MULTICLONE'S LOW MAINTENANCE...How the Multiclone has no high speed moving parts to repair or replace, no pads or filters to clean or renew, nothing to choke gas flow or increase draft losses as suspended materials are recovered. Multiclone draft losses remain uniformly low—recovery efficiencies uniformly high—at all times!

Make sure that a copy of this helpful booklet is in your reference files by sending for your copy now!

NO MATTER whether you are now using mechanical dust recovery equipment or are planning the installation of such equipment at some future date, here is a booklet that is full of helpful and valuable information on centrifugal dust recovery. It not only explains the basic methods and principles involved, but also shows the important differences between small and large diameter separating tubes, shows how to simplify your duct work and reduce installation costs, and outlines many other important factors to be considered in selecting mechanical dust recovery equipment.

In addition, this informative booklet illustrates and explains how MULTICLONE'S unique *vane* design is fundamentally different...how it makes possible greater compactness, simpler installation, high recovery of the small particles as well as the medium and coarser ones, and many other facts on MULTICLONE advanced design.

A limited supply of these booklets is available for free distribution to those interested in mechanical recovery equipment and methods. Write for your copy today.

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MULTICLONE Collectors
TURBULAIRE Spray Dryers

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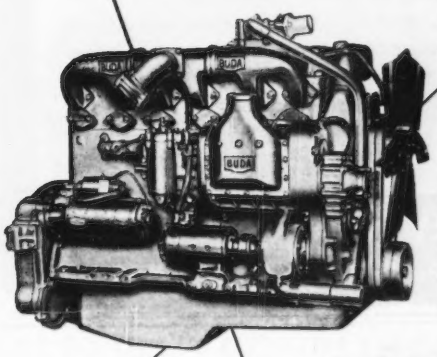
PRECIPITATION CO. OF CANADA, LTD., DOMINION SQ. BLDG., MONTREAL

14 BUDA SUPER Diesel-Powered "EUCS" Average 16 hrs. per day for 4 Years* WITHOUT MAJOR OVERHAULS!

Buda-Powered Euclid receiving 22 ton load of rock in the pit at Wyandotte Chemical, Alpena, Michigan.



The Buda 844 Super Diesels powering Wyandotte Chemical Company's 14 Model TD-14 Euclid trucks averaged 17,280 hours of operation over a 4 year period without major overhaul.

Buda Diesels provide high travel speeds for faster round trips.

Dependability like that, coupled with low operating cost . . . minimum maintenance and less downtime make Buda Diesels a good bet for any operator. Buda Diesels are giving mine operators more horsepower hours per dollar . . . more power . . . greater lugging ability and faster round trips under the toughest job conditions. Ask your nearby Buda Distributor for details on Buda dyna-swirl Diesels' outstanding performance on mine hauls like yours. Write for Bulletins and data today.

The Buda Company, Harvey, Illinois

*Work season—April through November.

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BUDA

a Power-Full and Dependable Name in Engines

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COAST TO COAST
FACTORY EXPERIENCED
SERVICE AND PARTS

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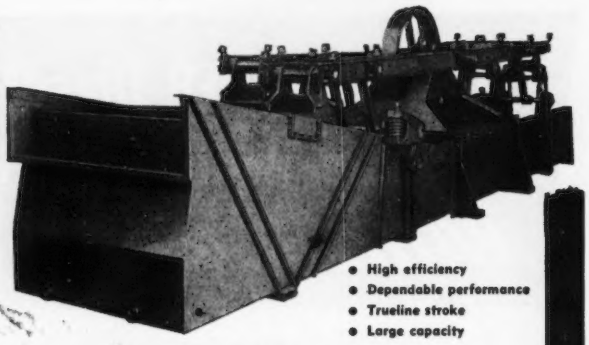
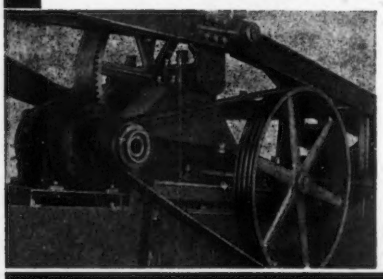
"Trueline"

RAKE CLASSIFIERS

DEPENDABLE CLASSIFIERS THAT IMPROVE PERFORMANCE, SIMPLIFY OPERATION AND LOWER MAINTENANCE.



- High efficiency
- Dependable performance
- Trueline stroke
- Large capacity



Large and quiescent pool areas give high overflow efficiency. Long "Trueline" strokes, parallel to the tank bottom, discharge the maximum quantity of sands. Fabricated steel construction gives extra strength and long service.

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Metallurgically Right

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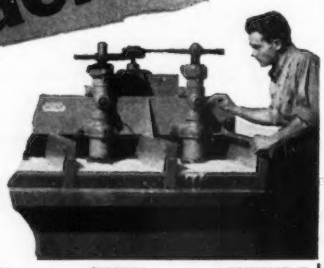
FLOTATION Machine



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Rubber
PINCH VALVES
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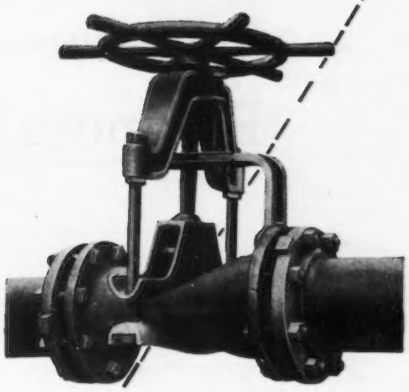

• Severe abrasive and corrosive pulps quickly destroys metal valves while these rubber pinch valves show little wear. They shut tight, even on solid particles. There are no packing glands, and freezing does not damage the patented hinged design sleeve. Sizes 1" to 12" available for continuous pressures up to 100-150 psi.

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Read the ads! Every issue of this magazine contains ads that offer valuable services and useful products by which your business may be run more profitably.

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McGRAW-HILL
publications

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Why guess when these low-cost, easy to operate Acker LD Core Drills tell you

Quickly!

Easily!

Inexpensively!

1. Quality of Coal
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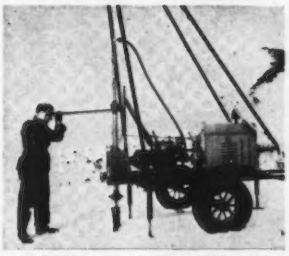
3. Depth of Overburden



Model LD powered with a 12HP motor for depths to 300'.

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For simplicity of design and operation you just can't beat the Acker LD. We've kept moving parts to a minimum and eliminated all feed gears or screws. (Elimination of unnecessary parts cuts down weight, too—an advantage when operating in isolated locations.)

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Write today for prices and Bulletin 21EMJ

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SCRANTON 3, PA.

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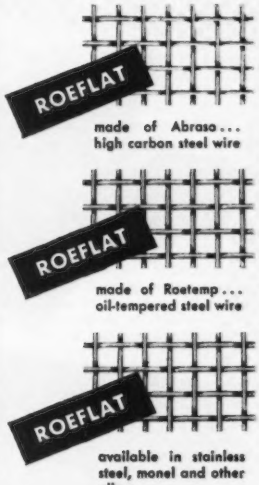
Roebling offers the right metal or alloy for extra economy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made of Abraso... high carbon steel wire
ROEFLAT
made of Roetemp... oil-tempered steel wire
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available in stainless steel, monel and other alloys

WHETHER ROEBLING ROEFLAT or some other construction best meets your screening requirements, Roebling goes a long step farther . . . offers you each and every construction in the exact metal or alloy to bring maximum screen life and economy in your operations.

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John A. Roebling's Sons Company
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Gentlemen: Please send me free copy of Catalog W-903 giving up-to-the-minute information about Aggregate Screens.

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Company.....
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. . . and clipped pertinent ideas, articles and advertisements for reference, *please do not burn or throw it away.*

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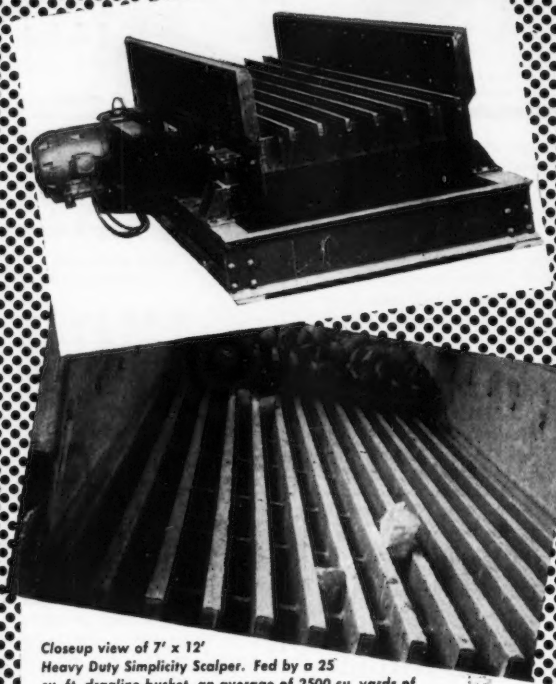
you can rely on SIMPLICITY SCALPERS



Closeup view of 7' x 12' Heavy Duty Simplicity Scalper. Fed by a 25 cu. ft. dragline bucket, an average of 2500 cu. yards of material passes through the 5" opening between the riding rails each hour. Approximately 250 cubic yards of boulders are scalped off the top.

Scalpers have to be tough to take the steady pounding of heavy impact loads . . . and that's the reason why Simplicity heavy duty scalpers are first choice when the going is rocky. For Simplicitys are tough, dependable and versatile. They not only handle straight scalping operations but can be used to feed crushers, handle rip-rap, and can also be equipped with a second deck for dirt removal. Simplicity Scalpers can be supplied with special rail type deck construction or perforated plate with or without rails. Simplicity units, built in sizes 3' x 8' to 7' x 12', will give you dependable, trouble-free operation . . . why not get the full story today. A Simplicity sales engineer will be glad to give you all the facts.

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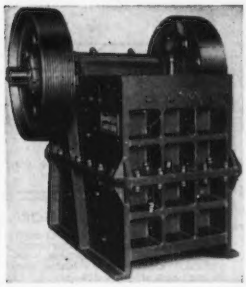
HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL publications

ROGERS

NEW! A Split Bed Crusher

for UNDERGROUND CRUSHING



This new ROGERS Jaw Crusher "knocks down" for lowering through mine shafts. Teamed with an apron feeder it increases ore production and saves man-power at the same time.

From underground to ball mill, rely on ROGERS synchronized equipment all the way!

Dimensions and Specifications on Request. We invite you to write. Let us tell you of installations in some of the country's largest mining operations to which you may refer for performance records.

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SAUERMAN DUROLITE WIRE ROPE BLOCKS

The sheaves and frames of Sauerman Durolite Blocks are of skeleton design and made from tough, high strength alloy steel, providing extreme lightness with great durability. Furnished either with roller bearings or bronze bearings ingeniously designed to take up end thrust and prevent sheave from contacting the frame. A bead cast on inside of frame protects edge of sheave flange. For underground work, Durolites are made with a wide throat that permits running of knotted ropes.

run smoother . . . last longer

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Similar results are reported by hundreds of other mine, pit and quarry operators and construction superintendents who now use Durolite Blocks exclusively. All of these buyers had used one or more different makes of blocks before trying Durolites. After switching to Durolites they found that they saved money in the long run and the light, easy-to-handle Durolites made friends among their workers. WRITE FOR CATALOG.

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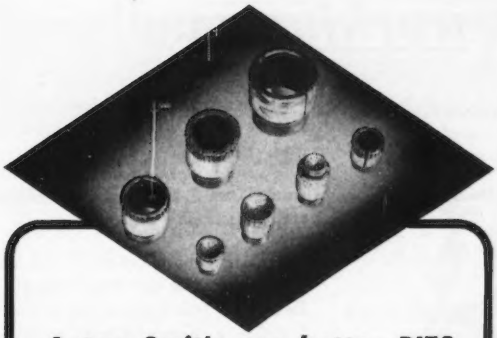

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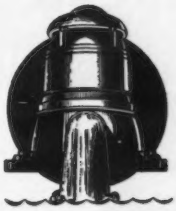

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This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

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CHIEF ENGINEER: Thoroughly experienced engineer with background of mine layout, mill design (both new construction and revamping), structural steel and concrete work, to head up engineering department of non-metallic underground mining and milling operation of medium size. Preferred age 30 to 40. Should be able to pass State examination for licensed Civil Engineer. Housing available. Location western state. When replying give complete experience record and state salary expected. P 9769, Enginering & Mining Jl.

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PROJECT ENGINEER Wanted: Executive Type, to age 45, Graduate Mining or Mechanical Engineer, well experienced directing design, and field installations on hard rock crushing and conveying plants. Underground mining experience desirable but not essential. Capable of assuming full responsibility on large projects. Location —Northeastern United States; frequent travel required; Position permanent with large national organization. Starting salary $8,000 to $9,000. Apply P 9822, Engineering & Mining Jl.

MINING ENGINEER with 2 years minimum practical underground or open pit experience to supervise special projects and miscellaneous mining work. Open pit, non-metallic, location California. Good opportunity. State full details including experience and references. P 9771, Engineering & Mining Jl.

MINING GEOLOGIST with a minimum of two years experience to assist chief geologist of an open pit, non-metallic operation in California. Geological drafting, mapping, logging diamond drill core, field work, field mapping and sampling. Good opportunity. State full details including experience and references. P-9772, Engineering & Mining Jl.

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P7942, Engineering & Mining Journal
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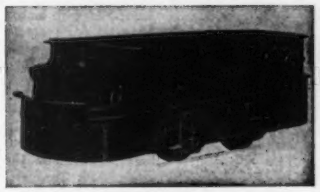

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One—No. 8 Right hand, Deister—Overtrom unit.

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2—48" single roll units with Nothelfer 115 volt AC to 25000 volts DC power packs.

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All equipment subject to prior sale.

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One G.E. 200 H.P. Motor, 3 bearing type, 585 RPM, 2200 volt, model MIN691, serial No. 1420792, 11 groove pulley.
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WAGON DRILL: Ingersoll Rand type D with X71 WD Drifter for 1-¼" steel with D-6-U hoist, mounted on steel wheels.

DRAG SCRAPERS, CRESCENT BUCKETS: 1—Sauerman 2 yd. Drag Scraper outfit complete, without 75 H.P. motor. 1—Sauerman ¾ yd. capacity complete with 30 H.P. motor. 1—Sauerman 1 yd. capacity complete with diesel motor.

BOILERS: 1—Erie City 150 H.P., ASME, return tubular, 4" tubes, 150 lbs. working pressure, pin hole grates and all fittings. 2—220 H.P., 160 lbs. pressure, National Board, 3 drum, low head, complete.

MINE HOISTS: Single and double drum, 150 H.P. to 2500 H.P.

BRIQUETTING PRESS: Capacity 18 tons per hour, 33" dia. rolls.

PUMP MOTORS: 2—1000 H.P., 1800 RPM, 2300 volt, complete with automatic control equipment, NEW, UNUSED.

TRUCKS: Euclid 15 yd., model T, end dump, 22 ton capacity, 275 H.P. Cummins motors.

CRUSHERS, REDUCTION: Symons 2 ft. standard bowl. Telsmith 2 ft. and 3 ft. Gyrasphere. Traylor 4 ft., type TY.

CLASSIFIER: WEMCO Simplex size 78"x28-½ ft., complete.

SCREENS: Simplicity 5 ft. x 12 ft., heavy duty, Scalping Screen for 11" material. Allis Chalmers low head, single deck, size 4 ft. x 16 ft.

A. J. O'NEILL
Lansdowne, Pa.
Phila. Phones: Madison 3-8300—3-8301

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Mining Machinery, Equipment, T. Rail, Hoists, Headframe, Ore Bin, Pumps, Compressor, Diamond Drill, Rods, Ball Mill, Flotation Cells, Assay Supplies, Cable, Stopers, Drills, Etc.

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- 120—36" Ga. Sanford - Day Bottom-Dump Cars
- 36" Ga. Trolley Locomotives
  5—10-Ton 4—4-Ton
  4—4-Ton - 24" Ga.

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Gas Electric — 35 ton — Double Truck; Standard Gauge; 6 Cyl. BUDA GAS ENGINE; 4 Elec. Driving Motors—One on Each Axle; DC Generators; Comb. Straight & Auto. Braking Equip't. WILL PULL 15 to 20 LOADED FREIGHT CARS ON LEVEL
Immediate delivery — Photograph available
Write for details
SEABOARD STEEL CO. INC. New Haven, Conn.

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1—Rex Heavy Duty 54"
Steel Slat Feeder

With Jones Herringbone Speed Reducer 10' 3" Centers. Good Used Condition with New Drive Shaft. Immediate Shipment—Priced to Sell. Write for Details:

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- Want or Offer a **BUSINESS OPPORTUNITY?**

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SEARCHLIGHT SECTION

of

ENGINEERING & MINING JOURNAL

MOTORS—M. G. SETS—TRANSFORMERS

SQUIRREL CAGE MOTORS
3-Phase, 60-Cycle

Qu.	HP	Make	Type	Volts	R.P.M.
1	400	G.E.	IK	2200	514
1	400	G.E.	KT-412	2200	435
2	300	Whse.	CS-890	2300	1760
1	250	Whse.	CS	2200	1160
1	200	Whse.	CS-873C	2200	1160
1	200	Al-Ch.	AR	440/220	580
2	125	Al-Ch.	AR	2200	1750
1	125	Whse.	CS-761C	440/220	1750
1	125	C.W.	126-Q	440/220	430
2	100	Whse.	CS-663C	440/220	1750
1	100	G.E.	IK	440/220	1800
1	100	Al-Ch.	AR	2200	1160
1	100	Al-Ch.	AR	550	690
1	100	F.M.	H741B	440/220	435
1	100	Whse.	CS-938	2200	495
1	78	G.E.	I-K15	440/220	570
1	75	Al-Ch.	AR	2200	1765
1	75	Al-Ch.	AR	2200	1750
1	75	Al-Ch.	AR	2200	690
1	50	G.E.	KT	440/220	1160

SYNCHRONOUS MOTORS
3-Phase, 60-Cycle

Qu.	H.P.	Make	P.F.	Volts	R.P.M.
1	3000	Whse.	80	4800/2400	720
1	700	G.E.	80	2300	720
1	600	Whse.	80	2400	720
1	400	Whse.	80	440	600
1	300	Whse.	80	440	514
1	268	Al-Ch.	100	2200	900
1	150	G.E.	100	2200	900
1	150	G.E.	100	550/2200	600
1	150	G.E.	80	550/2200	450
3	125	El. Mchy.	100	4800/2400	900
1	125	G.E.	80	2200	900
2	100	Whse.	80	440/220	1800
1	100	Whse.	100	2200	1200
1	100	Ideal	80	220/440	900
2	100	G.E.	80	220/440	600
1	60	G.E.	80	220/440	1200
2	50	G.E.	80	2200	600

SLIP RING MOTORS—CONSTANT DUTY
3-Phase, 60-Cycle

Qu.	HP	Make	Type	Volts	R.P.M.
1**	3000	G.E.	MT	2200	356
1**	1200	C.W.	SR	2200	237
2**	1000	Al-Ch.	ANY	2200	235
1**	600	G.E.	MT-20	2200	360
1	500	Whse.	C.W.	4600/2300	514
1	500	Al-Ch.	ANY	4000/2300	514
1**	400	G.E.	1M	2300	590
1**	400	Al-Ch.	ANY	2200	514
2	500	G.E.	I-16-M	2300	450
2	400	G.E.	MT-412	2200	450
1	300	G.E.	I-15-M	2200	1200
1	300	Al-Ch.	ANY	2200	514
1	250	G.E.	MT-414	2200	500
1	200	G.E.	I-16-M	2200	585
1	150	G.E.	I-13-M	2200	1750
1***	125	Whse.	CW-870	2200	870
1	100	F.M.	H20C	440/220	900
1	75	G.E.	1M	440/220	695
1	75	Whse.	CW-7540	440/220	690
1	60	Whse.	CW	440/220	900
1	50	G.E.	MT-536	2200	1150
2	50	Al-Ch.	ARY	440/220	900
1	50	F.M.	SR	440/220	600
1	50	Al-Ch.	ANY	2200/440	435

** Mill type pedestal bearing.
*** 3-Bearing.

MOTOR GENERATOR SETS

Qu.	K.W.	Make	R.P.M.	Volts D.C.	Volts A.C.
2	1000	G.E.	514	575	4000/2300
1	500(34)	Whse.	1200	120/240	2300/440
2	300	C.W.	720	575	4000/2300
1	500	C.W.	720	250/275	4000/2300
1	500	C.W.	720	250/275	2300/440
1	350	G.E.	720	250	2300/440
1	200	Ridgeway	900	250	2300
1	155	G.E.	720	250	2300/440
1	150	Al-Ch.	1200	250	2300/440
1	150	G.E.	1200	500	2300/440
1	100	Ridgway	1200	275	4000/2300
1	85	C.W.	1200	250	2300/440
1	75	Stur	1200	230	440/220
1	75	Al-Ch.	900	250	2300
1	50	Burke	1800	240	440/220
1	30	Reliance	1800	250	440/220
1	25	Whse.	1200	120/240	440/220
1	20	Reliance	1800	250	440/220

(34 — 3-UNIT SET)

DIRECT CURRENT MOTORS

Qu.	HP	Make	Type	R.P.M.
4***	300	Whse.	Encl.(Rev.)	600
1	350	G.E.	CD-169	1150
1	325	Whse.	QM-660. 6	450/900
1	250/250	El. Dy.	No. 22	400/1200
1***	200	G.E.	MPC	500/1200
1	200	Whse.	Mill	300/1200
1	300	Whse.		240/300
1	180	G.E.	MPC	400
2*	150	C.W.	83-H	890
1***	125	Whse.	SK-190	600
1	100/125	Rel.	1995-F	300/1200
2	100	Rel.	1050-T	400/1200
1	90/160	G.E.	MPC	625/1125
1*	50/75	Rel.	1995-F	300/1200
1	35	G.E.	RF-14	500/1500
1	35	G.E.	CD-125	400/1200
1	35	G.E.	CD-147	300/1200
1	35	Rex.	35P	250/1000
1	32½	Whse.	SK-150	400/1200
1*	30/75	Whse.	SK-151L	400/1200
1	30	Al-Ch.	E-145	400/1200
1	30	G.E.	CDM-105	875/1750
2	27½	El. Dy.	15S	450/1350
1	25	G.E.	RF-13	400/1600
1	25	G.E.	CD-123	400/1200
1	25	Whse.	SK-140	400/1200
1	25	Whse.	SK-111L	250/1000
2	20	Al-Ch.	E-130	400/1200
3	20	G.E.	CD-123	400/1200

All above 230-VDC except where marked ***.
***—Pedestal bearing mill design 525/600-VDC.
Rev.—designed for mill reversing service.
*—T.E.F.C.

TRANSFORMERS (POWER)

Qu.	K.V.A.	Make	Type	Phase	Voltage
1	7500	G.E.	H	3	33000/29700–13800/22600
1	4500	G.E.	HT	3	27000/24300–2300
3	1500(New)	Gregory	(X)	3	4160–480
2	750(New)	Gregory	(X)	3	4160–480
3	250	Packard	OISC	1	13200–2200
3	130	G.E.	H	1	19000/9500–550/2200

(X) New, Self-contained, Indoor Type, Air Cooled

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1—36″x14′8″ Rake Type Classifier—reconditioned.

1—Reconditioned mine hoist with drum capacity 500 ft. ½″ cable, clutch, brake, indicator.

Cast Iron Conveyor Pulleys
Agitators, Gates, Feeders

THE TELLURIDE IRON WORKS CO.
400 Main Ave., Durango, Colo.
Serving the San Juan District Since 1916.

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Magnetic Pulley: 15x21 with m.g. set etc.
Milling Plant: 6x6 Allis-Ch mill; Dorr classifier; American 3-leaf 6 ft. filter; 40x80 steel bldg. 440-v motors.
Mill: Marcy 6x6 and 440-v motor
Flotation: 4 Fags 44x44; motors 440-v
Crusher: 2 ft. Symons cone, 440 volts
Hoist: 100 hp 440-v double-drum
Headframe: 3-Comp. 60 ft. bolted steel
Compressor: 677 cfpm Ingersoll XB
Drill Sharpener: CDCo. #6 w/punch, etc
Bit Grinder: MGSSCo. TVM-38, motor 5 hp
Loaders: Eimco 12-B and Sullivan HL
Slusher: 3-drum Sullivan C312, motor 50 hp 220/440-v; 66″ blade scraper

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39 W. Adams St. • Phoenix, Arizona

FOR SALE
Immediate Shipment

1—24″ Gauge Battery Locomotive with two 40-cell batteries including all charging equipment.

1—50,000 gallon tower tank, 150 ft. high, all steel spherical bottom, cone roof or top.

2—Reels of new 1⅛″ Hazard Brand hoisting cable 6x19 plow steel, hemp center Seal construction, 6,850 ft. in each reel.
We also have a like amount in good used cable.

1—500 H.P. double drum mine hoist. All complete details on request.

1—6′x24 Dorr DSFX Heavy Duty Classifier.

1—4′6′ Eimco ball mill with Vee drive and motor.

1—Eimco 4′ dia. 6′ face drum filter, complete with all filtrate and vacuum equipment.

1—New Telsmith 48″ Gyrasphere Type S Secondary Crusher with grooved pulley.

1—New Telsmith 36″ Gyrasphere Type S Secondary Crusher with grooved pulley.

1—20′ dia. x 10′ deep Dorr Thickener, complete with redwood tank, overflow launder, low beam superstructure. Late model.

1—Ingersoll Rand Air Compressor, size 22 x 16 and 13 x 16 Duplex Imperial Type 10, complete with endless belt. Short belt idler and 160 HP motor with compensator, necessary piping and large air receiver. Capacity 960 cu. ft. actual at 270 RPM.

MINES ENGINEERING - EQUIPMENT CO.
369 Pine St. — San Francisco, Cal.

2 Eimco Mucking Machines Nos. 11-12.
1—10x20 Crusher, Alloy Steel & Metals Co.
1—30 HP Motor 440, 60 cycle, V-belt-to-flat drive for crusher.
1—Air Compressor—210 cu. ft. Ingersoll-Rand portable on wheels.
1—60 Cat., butane equipped, good condition.
3—Mine cars 20 ft. roller-bearing, slightly used.
FOR SALE, P.O. BOX 227, KINGMAN, ARIZ.

FOR SALE
MINE HOIST

Pneumatic tired Williams double-drum mine hoist, starter & lights, cat-head, slusher scraper, 15′ "A" frame for sinking, two snatch blocks. $1000.00 cash.
FS 9758 ENGINEERING & MINING JOURNAL
68 Post St., San Francisco 4, Calif.

12—Westinghouse Industrial Type precipitron cells complete with power equipment. Precipitron, Type "S" Style 1119283, Pri. Volts 60, Amps. 1.2, Watts 115, Cycle 60, Phases 1, Ionizer Volts 13000 DC, Plate Volts 6000 DC.

2—Cottrell Electrical Precipitators of two Units each having rated capacity of normal gas 108,000 c.f.m. Electrical equipment for 440 Volt, 3 Phase, 60 Cycle power. Complete description sent upon request.

Also miscellaneous milling equipment and motors of various sizes.

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MOTORS, GENERATORS, TRANSFORMERS
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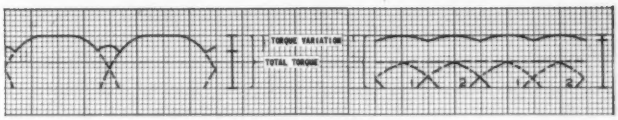
Much Longer Life FOR ROTARY KILN DRIVES WITH...

DUO-TORK (STAGGERED PINION) **Drive**

Duo-Tork drive eliminates "hard" gear tooth impulses. Pinion tooth in contact on pinion No. 1 is on centerline between gear tooth centers. Same tooth on pinion No. 2 is staggered — one-half tooth pitch past centerline.

How *Duo-Tork* Drive Affects Torque Variation



Single Drive with New A-C Gearing. *Duo-Tork* Drive with New A-C Gearing.

NEW *DUO-TORK* drive is a staggered pinion dual drive for large rotary kilns developed by Allis-Chalmers to give you twice as many gear tooth contacts per kiln revolution as a single drive (see above). The result is a smooth drive that protects the kiln, bearings, gears, reducer, shafting, and motor from destructive vibration.

Pinions are staggered so that they are one-half tooth pitch out of step. Vibration caused by gear tooth contact is practically eliminated. Each tooth impulse has only half the force of a comparable single drive. And *Duo-Tork* drive assures continuous production because kiln can be operated at reduced capacity using only half the drive.

Gear tooth shape has been improved, too. *Duo-Tork* drive utilizes the new 20° involute spur gear with long addendum pinion and short addendum gear tooth. The pinion tooth *rolls* evenly on gear tooth — *smooth, even* distribution of force from pinion to gear!

Other advantages of *Duo-Tork* drive:

- **Eliminates need for large *special* reducers and flexible couplings.**
- **Lower tooth pressures mean better gear lubrication, with no scoring or "wiping" of gear teeth.**
- **Maximum economy. *Duo-Tork* drive is less costly than single drive of over 125 hp. And, because wear is reduced, gearing lasts longer.**

For more facts, contact the A-C representative in your area or write Allis-Chalmers, Milwaukee 1, Wis. A-3280

ALLIS-CHALMERS

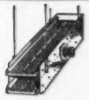
Duo-Tork and *Texrope* are Allis-Chalmers trademarks.

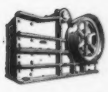
Sales Offices in Principal Cities in the U. S. A. Distributors Throughout the World.

Motors

Controls

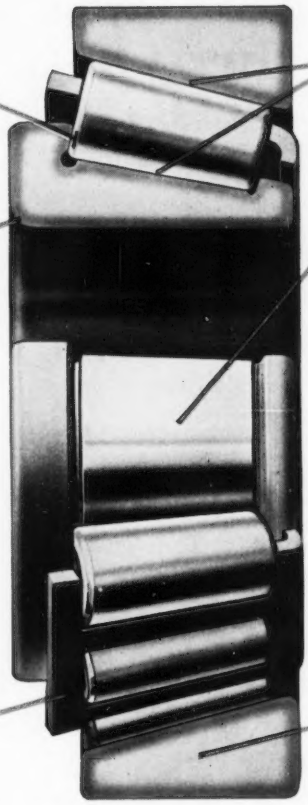
Texrope Drives


Vibrating Screens


Jaw Crushers

Kilns, Coolers, Dryers

10 reasons why your best bet in bearings is TIMKEN®



1 *Rib of cone maintains roller alignment, prevents skewing, assures maximum bearing capacity.*

2 *Generous radius permits greater shaft strength.*

3 *Available in 26 different types.*

4 *Precision manufactured. Available with runout tolerance of only seventy-five millionths of an inch (.000075").*

5 *Soft steel cage separates rollers, prevents scuffing.*

6 *Case-hardened surfaces resist wear.*

7 *Micro-inch surface finish makes friction negligible.*

8 *Available in 5850 sizes.*

9 *Made from Timken fine alloy steel for long bearing life.*

10 *Tough inner core resists shock.*

OTHER tapered roller bearings may *look* like Timken® bearings. But there is no other tapered roller bearing which gives you as many important advantages as you get with Timken.

Ten of these advantages are listed above. They all stem from the fact that the Timken Company is the foremost producer of tapered roller bearings and leads in (1) advanced design, (2) precision manufacture, (3) rigid quality control, (4) special analysis steels.

Be sure that every tapered roller bearing *you* use carries the name "Timken", the trade-mark of The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST ▯ LOADS OR ANY COMBINATION